# VOLUME I - PROJECT MANUAL

# Northwoods Park Middle School Gymnasium & Renovation

904 Sioux Dr.
Jacksonville, North Carolina 28540

## Onslow County Schools

**SMITH SINNETT ARCHITECTURE**

**PROJECT NO. 2022035.00**
**DATE: 17 JANUARY 2024**

**Owner**
Onslow County Schools
200 Broadhurst Road
Jacksonville, North Carolina 28540

**Architect**
Smith Sinnett Architecture, P.A.
4600 Lake Boone Trail, Suite 205
Raleigh, North Carolina 27607

**Civil Engineers/ Landscape Architect**
Timmons Group
5410 Trinity Road, Suite 102
Raleigh, North Carolina 27607

**Structural Engineer**
Kaydos Daniels
400-201 W Morgan St.
Raleigh, North Carolina 27603

**Plumbing, Mechanical and Electrical Engineers**
Progressive Design Collaborative
3101 Poplarwood Court, Suite 320
Raleigh, North Carolina 27604

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Raleigh, North Carolina 27604

## SECTION 00 00 05 – CERTIFICATIONS

**Onslow County Schools**

**Northwoods Park Middle School Addition & Renovation**
904 Sioux Dr
Jacksonville, North Carolina 28540

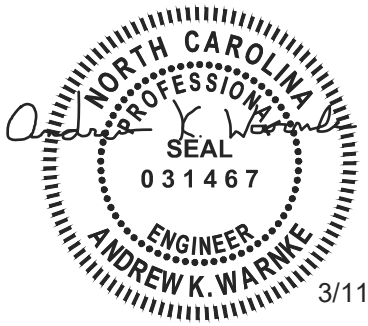
PROJECT NO. 2022035

**ARCHITECTURE FIRM**
Smith Sinnett Architecture, P.A.
4600 Lake Boone Trail, Suite 205
Raleigh, North Carolina 27607


**ARCHITECT – Les Parker, AIA**
Smith Sinnett Architecture, P.A.
4600 Lake Boone Trail, Suite 205
Raleigh, North Carolina 27607

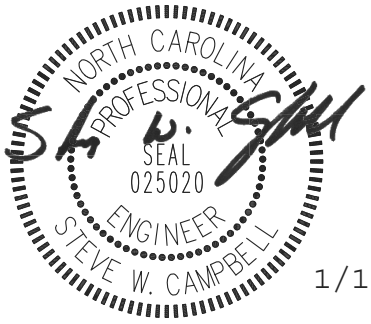

**CIVIL ENGINEER – William P. Altman, PE**
Timmons Group
5410 Trinity Road, Suite 102
Raleigh, North Carolina 27607

**STRUCTURAL ENGINEER – Andrew Warnke, PE**
Kaydos Daniels
400-201 W Morgan St.
Raleigh, North Carolina 27603



3/11/2024

**PLUMBING / MECHANICAL / FIRE PROTECTION ENGINEER – Steve Campbell, PE**
Progressive Design Collaborative
3101 Poplarwood Court, Suite 320
Raleigh, North Carolina 27604



1/19/24

**ELECTRICAL / FIRE ALARM – James Butkovich, PE**
Progressive Design Collaborative
3101 Poplarwood Court, Suite 320
Raleigh, North Carolina 27604

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1/19/24

## SECTION 00 01 00 – ADVERTISEMENT FOR BIDS

Sealed proposals will be received until **2:00 pm** on Thursday
**April 11th, 2024**, at Onslow County Schools
Offices, 200 Broadhurst Road, Jacksonville, NC 28540, in Meeting Room #4
for the construction of the
**Northwoods Park Middle School Gymnasium & Renovation**
**Jacksonville, NC**
at which time and place bids will be opened and read aloud.
A **Mandatory Pre-Bid Meeting** will be held at **10:00 am** on
**Tuesday March 19th, 2024** at the project site:
**Northwoods Park Middle School**
**904 Sioux Dr, Jacksonville NC 28540**
Check-in required at the main office. A site visit will follow.
Complete plans and specifications for this project can be
obtained by filling out the **'Document Request Form'**
from the Smith Sinnett Architecture website, www.smithsinnett.com/documents,
or by contacting Smith Sinnett Architecture, 4600 Lake Boone Trail,
Suite 205, Raleigh, NC 27607 (919)781-8582
during normal office hours after **March 11th, 2024**
The Onslow County Board of Education reserves the unqualified
right to reject any and all proposals. No Bid may be withdrawn after the scheduled closing
time for the receipt of bids for a period of 60 days.

**END OF SECTION 00 01 00**

## SECTION 00 01 05 – NOTICE TO BIDDERS

Sealed proposals will be received by the *Onslow County Schools* in *Jacksonville,* NC, at the *Onslow County Schools Office, 200 Broadhurst Road, Jacksonville, NC 28540, in Meeting Room #4* up to *2:00* pm *Thursday, April 11th,* 2024 and immediately thereafter publicly opened and read for the furnishing of labor, material and equipment entering into the construction of:

*Northwoods Park Middle School Gymnasium & Renovation*
*904 Sioux Dr, Jacksonville, North Carolina 28540*

*This bid package consists of the construction of an 18,129 square foot gymnasium, 10,385 renovation of existing athletic space into classrooms, and parking expansion, in Jacksonville, NC for Onslow County Schools. The gymnasium will include locker areas, associative storage, offices, a classroom, and concession. Renovation will include a science classroom, four general education classrooms, an office, and two resource spaces. Additional, included is all other work as shown, indicated or reasonably implied on the drawings and/or specifications for a complete, first class job.*

Bids will be received *for Single Prime Contractors.* All proposals shall be lump sum.

A Mandatory **Pre-Bid Meeting** will be held on *Tuesday March 19th, 2024 --- 10:00am --- at Northwoods Park Middle School: 904 Sioux Dr, Jacksonville, North Carolina 28540.* The meeting will address project specific questions, issues, bidding procedures and bid forms. The meeting will continue at the project site where contractors will be permitted to walk the project site.

The meeting is also to identify preferred brand alternates and their performance standards that the owner will consider for approval on this project. In accordance with General Statute GS 133-3, Specifications may list one or more preferred brands as an alternate to the base bid in limited circumstances. Specifications containing a preferred brand alternate under this section must identify the performance standards that support the preference. Performance standards for the preference must be approved in advance by the owner in an open meeting. Any alternate approved by the owner shall be approved only where (i) the preferred alternate will provide cost savings, maintain or improve the functioning of any process or system affected by the preferred item or items, or both, and (ii) a justification identifying these criteria is made available in writing to the public. In accordance with GS133-3 procedures the following preferred brand items are being considered as Alternates by the owner for this project:

**Alternate #1: Paint Existing Exposed Steel**
- a) Paint Exterior Steel as defined in drawins and specifications

**Alternate #2: Owner Preferred Manufacturer - Door Hardware**
- a) Door Locks: Manufacturer – Schlage
- b) Exit Devices: Manufacturer – Von Duprin
- c) Closers: Manufacturer – LCN

**Alternate #3: Owner Preferred Manufacturer(s) – Plumbing**
- a) Water Cooler with Bottle Filler: Manufacturer – Elkay

**Alternate #4: Owner Preferred Manufacturer(s) – HVAC**
- a) Trane – Existing Building Renovations
- b) Aaon – New Gymnasium Building
- c) HVAC Controls: Manufacturers – Schneider **OR** Brady

**Alternate #5: Owner Preferred Manufacturer(s) – Electrical**
- a) Fire Alarm System: Manufacturer – Notifier
- b) Electrical Equipment: Manufacturer – Square D
- c) Intercom Equipment: Manufacturer – Nyquist

**Alternate #6: Owner Preferred Manufacturer – Termite Treatment**
- a) Termiticide – Termidor

**Alternate #7: Owner Preferred Manufacturer – Translucent Wall Assembly**
- a) Kalwall

Justification of any approvals will be made available to the public in writing no later than seven (7) days prior to bid date.

Complete plans, specifications and contract documents will be open for inspection in the offices of *Smith Sinnett Architecture, P.A., 4600 Lake Boone Trail, Suite 205, Raleigh, North Carolina 27607 and Onslow County Schools, 200 Broadhurst Road, Jacksonville, NC 28540* and in the plan rooms of the Associated General Contractors, McGraw-Hill Dodge Corporation, and in the Eastern Regional Office of Reed Construction Data in Norcross, GA and in the Minority Plan Room listed below:

Hispanic Contractors Association of the Carolinas (HCAC) in Winston-Salem, Charlotte and Raleigh Areas – 877-227-1680

Plans and Specifications can be downloaded from Smith Sinnett Architecture by potential bidders, upon registration with Smith Sinnett by completing the Intent to Bid Form available at www.smithsinnett.com. The full hard copy of the plans and specifications can be purchased at the contractor's expense.

**NOTE**: The bidder shall include with the bid proposal the form *Identification of Minority Business Participation* identifying the minority business participation it will use on the project and shall include either *Affidavit **A*** or *Affidavit **B*** as applicable. Forms and instructions are included within the Proposal Form in the bid documents. Failure to complete these forms is grounds for rejection of the bid. (GS143-128.2c Effective 1/1/2002.)

All contractors are hereby notified that they must have proper license as required under the state laws governing their respective trades. General contractors are notified that Chapter 87, Article 1, General Statutes of North Carolina, will be observed in receiving and awarding general contracts. General contractors submitting bids on this project must have license classification for "Unlimited Building" or "Unclassified," required by the NC General Contractors Licensing Board under G.S. 87-1.)

NOTE: SINGLE PRIME CONTRACTS: Under GS 87-1, a contractor that superintends or manages construction of any building, highway, public utility, grading, structure or improvement shall be deemed a "general contractor" and shall be so licensed. Therefore a single prime project that involves other trades will require the single prime contractor to hold a proper General Contractors license. EXCEPT: On public buildings being bid single prime, where the total value of the general construction does not exceed 25% of the total construction value, contractors under GS87- Arts 2 and 4 (Plumbing, Mechanical & Electrical) may bid and contract directly with the Owner as the SINGLE PRIME CONTRACTOR and may subcontract to other properly licensed trades. GS87-1.1- Rules .0210

Each proposal shall be accompanied by a cash deposit or a certified check drawn on some bank or trust company, insured by the Federal Deposit Insurance Corporation, of an amount equal to not less than five percent (5%) of the proposal, or in lieu thereof a bidder may offer a bid bond of five percent (5%) of the bid executed by a surety company licensed under the laws of North Carolina to execute the contract in accordance with the bid bond. Said deposit shall be retained by the owner as liquidated damages in event of failure of the successful bidder to execute the contract within ten days after the award or to give satisfactory surety as required by law.

A performance bond and a payment bond will be required for one hundred percent (100%) of the contract price.

Payment will be made based on ninety-five percent (95%) of monthly estimates and final payment made upon completion and acceptance of work.

No bid may be withdrawn after the scheduled closing time for the receipt of bids for a period of **60** days.

The Owner reserves the right to reject any or all bids and to waive informalities.

| Designer: | Owner: |
|---|---|
| *Ed Gordon,* | *Dr. Brendan Gartner,* |
| *Principal, Smith Sinnett Architecture, P.A.* | *Chief Of Operations Onslow County Schools* |
| *(Name)* | *(Agency/Institution)* |
| *4600 Lake Boone Trail, Suite 205* | *200 Broadhurst Road* |
| *Raleigh, North Carolina 27607* | *Jacksonville, North Carolina 28540* |
| *(Address)* | *(Address)* |
| *(919) 781-8582* | *(910) 455-2211* |
| *(Phone)* | *(Phone)* |

**END OF SECTION 00 01 05**

SECTION 00 01 10 - TABLE OF CONTENTS

**PROJECT:** Northwoods Park Middle School Gymnasium & Renovation
904 Sioux Dr
Jacksonville, North Carolina 28540

VOLUME I

**END OF SECTION 00 01 10**

# AIA® Document A701® – 2018

## *Instructions to Bidders*

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

2022035 Northwoods Park Middle Gymnasium and Renovation
Jacksonville, NC
Add Gymnasium facilities and renovate existing Gym to Classrooms. May include several additional classrooms.

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

Onslow County Board of Education
200 Broadhurst Road
Post Office Box 99
Jacksonville, North Carolina 28540

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

Smith Sinnett Architecture, P.A.
4600 Lake Boone Trail, Suite 205
Raleigh, North Carolina 27607

**TABLE OF ARTICLES**



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

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

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

It is intended that AIA Document G612™–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 Project Manual dated 19 October 2023.

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

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

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

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

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

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

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

Refer to Project Manual dated 19 October 2023.

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

**§ 3.3 Substitutions**

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

**§ 3.3.2 Substitution Process**

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

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

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

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

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

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

**§ 3.4 Addenda**

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

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

Refer to Project Manual dated 19 October 2023.

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

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

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

**ARTICLE 4 BIDDING PROCEDURES**

**§ 4.1 Preparation of Bids**

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

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

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

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

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

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

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

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

**§ 4.2 Bid Security**

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

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

Refer to Project Manual dated 19 October 2023.

**§ 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. 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.

**§ 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.)*

Refer to Project Manual dated 19 October 2023.

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

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

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

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

**§ 4.4 Modification or Withdrawal of Bid**

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

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

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

Refer to Project Manual dated 19 October 2023.

## ARTICLE 5 CONSIDERATION OF BIDS

**§ 5.1 Opening of Bids**

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

**§ 5.2 Rejection of Bids**
Unless otherwise prohibited by law, the Owner shall have the right to reject any or all Bids.

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

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

## ARTICLE 6 POST-BID INFORMATION

**§ 6.1 Contractor's Qualification Statement**
Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request and within the timeframe specified by the Architect, a properly executed AIA Document A305™, 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.

## 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.
*(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.)*

Refer to Project Manual dated 19 October 2023.

**§ 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 A101™–2017, Standard Form of Agreement Between Owner and Contractor, unless otherwise stated below.
*(Insert the complete AIA Document number, including year, and Document title.)*

Refer to Project Manual dated 19 October 2023.

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

Refer to Project Manual dated 19 October 2023.

**.3** AIA Document A201™–2017, General Conditions of the Contract for Construction, unless otherwise stated below.
*(Insert the complete AIA Document number, including year, and Document title.)*

Refer to Project Manual dated 19 October 2023.

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

Refer to Project Manual dated 19 October 2023.

**.5** Drawings

| Number | Title | Date |
|---|---|---|
| Refer to Construction Documents | | 19 October 2023 |

**.6** Specifications

| Section | Title | Date | Pages |
|---|---|---|---|
| Refer to Project Manual | | 19 October 2023 | |

**.7** Addenda:

| Number | Date | Pages |
|---|---|---|
| Refer to Project Manual | 19 October 2023 | |

**.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 |
|---|---|---|---|
| Refer to Project Manual | | 19 October 2023 | |

**.9** Other documents listed below:
*(List here any additional documents that are intended to form part of the Proposed Contract Documents.)*

## SECTION 00 42 00 - PROPOSAL FORM

PROJECT: Northwoods Park Middle School Gymnasium & Renovation
904 Sioux Dr
Jacksonville, North Carolina 28540

OWNER: Onslow County Schools
200 Broadhurst Road
Jacksonville, North Carolina 28540

ARCHITECT: Smith Sinnett Architecture
4600 Lake Boone Trail, Suite 205
Raleigh, North Carolina 27607

The undersigned, as bidder, hereby declares that the only person or persons interested in this proposal as principal or principals is or are named herein and that no other person than herein mentioned has any interest in this proposal or in the contract to be entered into; that this proposal is made without connection with any other person, company or parties making a bid or proposal; and that it is in all respects fair and in good faith without collusion or fraud. The bidder further declares that he has examined the site of the work and the contract documents relative thereto, and has read all special provisions furnished prior to the opening of bids; that he has satisfied himself relative to the work to be performed.

The Bidder proposes and agrees if this proposal is accepted to contract with ***Onslow County Schools Board of Education*** in the form of contract specified below, to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation and labor necessary to complete the construction of

**Northwoods Park Middle School Gymnasium & Renovation**

in full in complete accordance with the plans, specifications and contract documents, to the full and entire satisfaction of the Onslow County Schools Board of Education, and Smith Sinnett Architecture with a definite understanding that no money will be allowed for extra work except as set forth in the General Conditions and the contract documents.

The low Bidder will be determined by the total cost of the Contract with the lump sum prices of the alternates accepted being added to or deducted from the Base Bid to give the total cost of the Contract. Bidders are required to give a price for Base Bid, all Alternates, and all Unit Prices as applicable to their Contract. All Bidders are required to be licensed and in good standing with their respective North Carolina Licensing Board.

**SINGLE PRIME CONTRACT**:

**BASE BID:**

Amount: _____ Dollars ($_____)

**ALTERNATE 1: Paint Existing Exposed Steel**

Amount: _____ Dollars ($_____)

**ALTERNATE 2: Preferred Door Hardware Manufacturers**

Amount: _____ Dollars ($_____)

**ALTERNATE 3: Preferred Plumbing Manufacturers**

Amount: _____ Dollars ($_____)

**ALTERNATE 4: Preferred Mechanical Manufacturers**

Amount: _____ Dollars ($_____)

**ALTERNATE 5: Preferred Electrical Manufacturers**

Amount: _____ Dollars ($_____)

**ALTERNATE 6: Preferred Termite Treatment Manufacturer**

Amount: _____ Dollars ($_____)

**ALTERNATE 7: Preferred Translucent Wall Manufacturer**

Amount: _____ Dollars ($_____)

**MAJOR SUBCONTRACTORS if any** (Name, City & State)

General Subcontractor: Plumbing Subcontractor:

_____Lic_____ _____Lic_____

Mechanical Subcontractor: Electrical Subcontractor:

_____Lic_____ _____Lic_____

GS143-128(d) requires all single prime bidders to identify their subcontractors for the above subdivisions of work. A contractor whose bid is accepted shall not substitute any person as subcontractor in the place of the subcontractor listed in the original bid, except (i) if the listed subcontractor's bid is later determined by the contractor to be non-responsible or non-responsive or the listed subcontractor refuses to enter into a contract for the complete performance of the bid work, or (ii) with the approval of the awarding authority for good cause shown by the contractor.

**ALLOWANCES**

(Refer to Division 01 Section 01 21 00 – Allowances for amounts to be included in bid. Allowance amounts shall be based on the Unit Prices provided as part of Section 01 22 00). Acknowledge Allowances have been included with in the Base Bid and designated Alternates.

| Included within **BASE BID**: | Acknowledgement |
|---|---|
| **UP/A-1: Unsuitable soils removal and disposal off-site** | ☐ |
| **UP/A-2: Replacement with off-site suitable soil in-place** | ☐ |
| **UP/A-3: Replacement with Aggregate Base Course (ABC) stone material** | ☐ |
| **UP/A-4: Replacement with #57 Washed Stone material** | ☐ |
| **UP/A-5: Woven Geo-Textile Fabric in place** | ☐ |
| **UP/A-6: Biaxial Geo-Grid in place** | ☐ |
| **UP/A-7: Subsurface Drain** | ☐ |
| **UP/A-8: Topical Moisture Mitigation System** | ☐ |
| A-9: Access Control – Security Cameras, Intrusion Detection, & Card Readers | ☐ |
| A-10: Structured Cabling | ☐ |
| A-11: Technology, Furnishings, & Gymnasium Sound System | ☐ |
| A-12: Appliances | ☐ |
| A-13: Signage | ☐ |
| A-14: Bi-directional Amplification | ☐ |
| A-15: Contingency | ☐ |

## UNIT PRICES

(Refer to Division 01 Section 01 22 00 - Unit Prices. For quantities, refer to Section 01 21 00 - Allowances). Unit prices quoted and accepted shall apply throughout the life of the contract, except as otherwise specifically noted. Unit prices shall be applied, as appropriate, to compute the total value of changes in the Base Bid and designated Alternates quantity of the work and in the given Allowances all in accordance with the contract documents.

BASE BID Unit Prices:

**Unit Price No. UP/A-1**: Unsuitable Soils Removal and Disposal off-site: per cy. Unit Price ($)_____

**Unit Price No. UP/A-2**: Replacement with Off-site Suitable Soil In-place: per cy. Unit Price ($)_____

**Unit Price No. UP/A-3:** Replacement with Aggregate Base Course stone material: per cy. Unit Price ($)_____

**Unit Price No. UP/A-4:** Replacement with #57 Washed Stone Material: per cy. Unit Price ($)_____

**Unit Price No. UP/A-5:** Woven Geo-Textile Fabric in place: per square yard. Unit Price ($)_____

**Unit Price No. UP/A-6:** Biaxial Geo-Grid in place: per square yard. Unit Price ($)_____

**Unit Price No. UP/A-7:** Subsurface Drain: per lf. Unit Price ($)_____

**Unit Price No. UP/A-8:** Topical Moisture Mitigation System: per square foot Unit Price ($)_____

The bidder further proposes and agrees hereby to commence work under this contract on a date to be specified in a written order of the designer and shall fully complete all work thereunder within the time specified in the Supplementary General Conditions Article 9. Applicable liquidated damages amount is also stated in the Supplementary General Conditions Article 9.

The bidder certifies that as of the date of this bid, the bidder submitting this bid is not listed on the Final Divestment List created by the State Treasurer pursuant to N.C. Gen. Stat. § 143-6A-4. The individual signing this bid form certifies that he or she is authorized by the bidder to make the foregoing statement.

## ADDENDUM

(Addendum received and used in computing bid)

Addendum No. 1 _____ Addendum No. 3 _____ Addendum No. 5_____

Addendum No. 2 _____ Addendum No. 4 _____ Addendum No. 6 _____

## PROPOSAL SIGNATURE

The undersigned further agrees that in the case of failure on his part to execute the said contract and the bonds within ten (10) consecutive calendar days after being given written notice of the award of contract, the certified check, cash or bid bond accompanying this bid shall be paid into the funds of the owner's account set aside for the project, as liquidated damages for such failure; otherwise the certified check, cash or bid bond accompanying this proposal shall be returned to the undersigned. No proposal may be withdrawn after the scheduled closing time for the receipt of Bids for a period of sixty (60) days.

Respectfully submitted this day of _____

_____
(Name of firm or corporation making bid)

WITNESS:

By: _____
Signature

_____
(Proprietorship or Partnership)

Name: _____
Print or type

Title: _____
(Owner/Partner/Pres./V.Pres)

Address: _____

ATTEST:

_____

By: _____

License No. _____

Title: _____
(Corp. Sec. or Asst. Sec. only)

Federal I.D. No. _____

(CORPORATE SEAL)

**MINORITY BUSINESS PARTICIPATION REQUIREMENTS**

*Provide with the bid* - Under GS 143-128.2(c) the undersigned bidder shall identify **on its bid** (Identification of Minority Business Participation Form) the minority businesses that it will use on the project with the total dollar value of the bids that will be performed by the minority businesses. **Also** list the good faith efforts (Affidavit **A**) made to solicit minority participation in the bid effort.

**NOTE**: A contractor that performs all of the work with its own workforce may submit an Affidavit (**B)** to that effect in lieu of Affidavit (**A)** required above. The MB Participation Form must still be submitted even if there is zero participation.

*After the bid opening* - The Owner will consider all bids and alternates and determine the lowest responsible, responsive bidder. Upon notification of being the apparent low bidder, the bidder shall then file within 72 hours of the notification of being the apparent lowest bidder, the following:

An Affidavit (**C**) that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, which is equal to or more than the 10% goal established. This affidavit shall give rise to the presumption that the bidder has made the required good faith effort and Affidavit **D** is not necessary;

*** OR ***

If less than the 10% goal, Affidavit (**D**) of its good faith effort to meet the goal shall be provided. The document must include evidence of all good faith efforts that were implemented, including any advertisements, solicitations and other specific actions demonstrating recruitment and selection of minority businesses for participation in the contract.

**Note**: Bidders must always submit **with their bid** the Identification of Minority Business Participation Form listing all MB contractors, vendors and suppliers that will be used. If there is no MB participation, then enter none or zero on the form. Affidavit A **or** Affidavit B, as applicable, also must be submitted with the bid. Failure to file a required affidavit or documentation with the bid or after being notified apparent low bidder is grounds for rejection of the bid.

**END OF SECTION 00 42 00**

# AIA® Document A310™ – 2010

## *Bid Bond*

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

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

**OWNER:**
*(Name, legal status and address)*
Onslow County Board of Education
200 Broadhurst Road
Post Office Box 99
Jacksonville, North Carolina 28540

**BOND AMOUNT:** $

**PROJECT:**
*(Name, location or address, and Project number, if any)*
Northwoods Park Middle School Gymnasium and Renovation
904 Sioux Dr
Jacksonville, NC 28540

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

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

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

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

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

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

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

Signed and sealed this day of ,

| | |
|---|---|
| | *(Contractor as Principal)* *(Seal)* |
| *(Witness)* | *(Title)* |
| | *(Surety)* *(Seal)* |
| *(Witness)* | *(Title)* |

## SECTION 00 43 39 - MINORITY BUSINESS

The North Carolina General Statutes require that bids be awarded to the lowest responsible, responsive bidder "without regard to race, religion, color, creed, national origin, sex, age, or handicapping condition." Also, contractors are not required to make purchases of materials or equipment or award subcontracts to minority businesses that do not submit the lowest responsible bid(s). NCGS 143.128.2 requires each city, county, or other local public entity to adopt a verifiable percentage goal for participation by minority businesses in the total value of work for building projects. **Onslow County Schools** has adopted a goal of ten percent (10%). Public entities shall require contractors to make good faith efforts in the recruitment and selection of minority businesses for participation in building construction projects.

The term "minority business" means a business:

a. In which at least fifty-one percent (51%) is owned by one or more minority persons or socially and economically disadvantaged individuals, or in the case of a corporation, in which at least fifty-one percent (51%) of the stock is owned by one or more minority persons or socially and economically disadvantaged individuals; and
b. Of which the management and daily business operations are controlled by one or more of the minority persons or socially and economically disadvantaged individuals who own it.

A "Minority" is a person who is a citizen of lawful permanent resident of the United States and who is:

a. Black, that is, a person having origins in any of the black racial groups in Africa;
b. Hispanic, that is, a person of Spanish or Portuguese culture with origins in Mexico, South or Central America, or the Caribbean Islands, regardless of race;
c. Asian American, that is, a person having origins in any of the original peoples of the Far East, Southeast Asia and Asia, the Indian subcontinent, or the Pacific Islands;
d. American Indian, that is, a person having origins in any of the original Indian peoples of North America; or
e. Female

The term "socially and economically disadvantaged individual" means the same as defined in 15 U.S.C. 637. "Socially disadvantaged individuals are those who have been subjected to racial or ethnic prejudice or cultural bias because of their identity as a member of a group without regard to their individual qualities." "Economically disadvantaged individuals are those socially disadvantaged individuals whose ability to compete in the free enterprise system has been impaired due to diminished capital and credit opportunities as compared to others in the same business area who are not socially disadvantaged."

Each bidder shall identify on its bid the minority businesses that it will use on the project (MBE-1 "Identification of Minority Business Participation", the total value of the bid that will be performed by the minority businesses, and an affidavit (MBE-2 "Affidavit A") listing the good faith efforts it has made. A contractor that performs all of the work under a contract with its own workforce may submit an affidavit (MBE-3 "Affidavit B") in lieu of Affidavit A.

The apparent lowest responsible, responsive bidder shall within 72 hours of being notified of being the low bidder file one of the following:

a. MBE-4 "Affidavit C" if the portion of the work to be executed by minority businesses is equal to or greater than 10% of the bidders total contract price; or
b. MBE-5 "Affidavit D" and required documentation of the good faith efforts, if the goal of 10% participation by minority businesses is not achieved.

No subcontractor listed in this documentation may be replaced with a different subcontractor except:

a. if the subcontractor's bid is later determined to be non-responsible or non-responsive, or if the subcontractor refuses to enter into a contract for the work, or
b. With the approval of the Owner for good cause.

**END OF SECTION 00 43 39**

# Identification of HUB Certified/ Minority Business Participation

I,_____,
(Name of Bidder)
do hereby certify that on this project, we will use the following HUB Certified/ minority business as construction subcontractors, vendors, suppliers or providers of professional services.

| Firm Name, Address and Phone # | Work Type | *Minority Category | **HUB Certified (Y/N) |
|---|---|---|---|
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*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

**** HUB Certification with the state HUB Office required to be counted toward state participation goals.**

**The total value of minority business contracting will be ($)_____.**

## AFFIDAVIT A – Listing of Good Faith Efforts

**County of** _____

Affidavit of_____
(Name of Bidder)

I have made a good faith effort to comply under the following areas checked:
**Bidders must earn at least 50 points from the good faith efforts listed for their bid to be considered responsive.** (1 NC Administrative Code 30 I.0101)

- ☐ **1 – (10 pts)** Contacted minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor, or available on State or local government maintained lists, at least 10 days before the bid date and notified them of the nature and scope of the work to be performed.
- ☐ **2 --(10 pts)** Made the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bids are due.
- ☐ **3** – **(15 pts)** Broken down or combined elements of work into economically feasible units to facilitate minority participation.
- ☐ **4 – (10 pts)** Worked with minority trade, community, or contractor organizations identified by the Office of Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.
- ☐ **5** – **(10 pts)** Attended prebid meetings scheduled by the public owner.
- ☐ **6** – **(20 pts)** Provided assistance in getting required bonding or insurance or provided alternatives to bonding or insurance for subcontractors.
- ☐ **7 – (15 pts)** Negotiated in good faith with interested minority businesses and did not reject them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.
- ☐ **8** – **(25 pts)** Provided assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisted minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.
- ☐ **9** – **(20 pts)** Negotiated joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.
- ☐ **10** - **(20 pts)** Provided quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

The undersigned, if apparent low bidder, will enter into a formal agreement with the firms listed in the Identification of Minority Business Participation schedule conditional upon scope of contract to be executed with the Owner. Substitution of contractors must be in accordance with GS143-128.2(d) Failure to abide by this statutory provision will constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of the minority business commitment and is authorized to bind the bidder to the commitment herein set forth.

Date:_____ Name of Authorized Officer:_____
Signature:_____
Title:_____

SEAL

State of_____, County of_____
Subscribed and sworn to before me this _____day of _____20____
Notary Public_____
My commission expires _____

## AFFIDAVIT B -- Intent to Perform Contract with Own Workforce.

**County of _____**

Affidavit of_____
(Name of Bidder)

I hereby certify that it is our intent to perform 100% of the work required for the

_____contract.
(Name of Project)

In making this certification, the Bidder states that the Bidder does not customarily subcontract elements of this type project, and normally performs and has the capability to perform and will perform all elements of the work on this project with his/her own current work forces; and

The Bidder agrees to provide any additional information or documentation requested by the owner in support of the above statement. The Bidder agrees to make a Good Faith Effort to utilize minority suppliers where possible.

The undersigned hereby certifies that he or she has read this certification and is authorized to bind the Bidder to the commitments herein contained.

Date:_____Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of _____, County of_____
Subscribed and sworn to before me this _____day of _____20___
Notary Public _____
My commission expires_____

# AFFIDAVIT C - Portion of the Work to be Performed by HUB Certified/Minority Businesses

**County of _____**

**(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)**

If the portion of the work to be executed by HUB certified/minority businesses as defined in GS143-128.2(g) and 128.4(a),(b),(e) is equal to or greater than 10% of the bidders total contract price, then the bidder must complete this affidavit.
This affidavit shall be provided by the apparent lowest responsible, responsive bidder within **72 hours** after notification of being low bidder.

Affidavit of _____ I do hereby certify that on the
(Name of Bidder)

_____
(Project Name)

Project ID#_____ Amount of Bid $_____

I will expend a minimum of _____% of the total dollar amount of the contract with minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below.

Attach additional sheets if required

| Name and Phone Number | *Minority Category | **HUB Certified Y/N | Work Description | Dollar Value |
|---|---|---|---|---|
| | | | | |
| | | | | |
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*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

**** HUB Certification with the state HUB Office required to be counted toward state participation goals.**

Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date:_____ Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of _____, County of _____
Subscribed and sworn to before me this _____day of _____20____
Notary Public_____
My commission expires_____

## AFFIDAVIT D – Good Faith Efforts

**County of _____**

**(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)**

If the goal of 10% participation by HUB Certified/ minority business **is not** achieved, the Bidder shall provide the following documentation to the Owner of his good faith efforts:

Affidavit of _____ I do hereby certify that on the
(Name of Bidder)

_____
(Project Name)

Project ID#_____ Amount of Bid $_____

I will expend a minimum of _____% of the total dollar amount of the contract with HUB certified/ minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. (Attach additional sheets if required)

| Name and Phone Number | *Minority Category | **HUB Certified Y/N | Work Description | Dollar Value |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

**** HUB Certification with the state HUB Office required to be counted toward state participation goals.**

**Examples** of documentation that may be required to demonstrate the Bidder's good faith efforts to meet the goals set forth in these provisions include, but are not necessarily limited to, the following:

A. Copies of solicitations for quotes to at least three (3) minority business firms from the source list provided by the State for each subcontract to be let under this contract (if 3 or more firms are shown on the source list). Each solicitation shall contain a specific description of the work to be subcontracted, location where bid documents can be reviewed, representative of the Prime Bidder to contact, and location, date and time when quotes must be received.

B. Copies of quotes or responses received from each firm responding to the solicitation.

C. A telephone log of follow-up calls to each firm sent a solicitation.

D. For subcontracts where a minority business firm is not considered the lowest responsible sub-bidder, copies of quotes received from all firms submitting quotes for that particular subcontract.

E. Documentation of any contacts or correspondence to minority business, community, or contractor organizations in an attempt to meet the goal.

F. Copy of pre-bid roster

G. Letter documenting efforts to provide assistance in obtaining required bonding or insurance for minority business.

H. Letter detailing reasons for rejection of minority business due to lack of qualification.

I. Letter documenting proposed assistance offered to minority business in need of equipment, loan capital, lines of credit, or joint pay

agreements to secure loans, supplies, or letter of credit, including waiving credit that is ordinarily required.

Failure to provide the documentation as listed in these provisions may result in rejection of the bid and award to the next lowest responsible and responsive bidder.

Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date:_____ Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of _____, County of _____

Subscribed and sworn to before me this _____day of _____20____

Notary Public_____

My commission expires _____

# AIA® Document A201® – 2017

## *General Conditions of the Contract for Construction*

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

Northwoods Park Middle School Gymnasium and Renovation
904 Sioux Drive
Jacksonville, North Carolina 28540

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

Onslow County Board of Education
200 Broadhurst Road
Jacksonville, North Carolina 28540

**THE ARCHITECT:**
*(Name, legal status and address)*
Smith Sinnett Architecture, P.A.
4600 Lake Boone Trail, Suite 205
Raleigh, North Carolina 27607

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

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

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

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## ARTICLE 1 GENERAL PROVISIONS

### § 1.1 Basic Definitions

#### § 1.1.1 The Contract Documents

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

#### § 1.1.2 The Contract

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

#### § 1.1.3 The Work

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

#### § 1.1.4 The Project

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

#### § 1.1.5 The Drawings

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

#### § 1.1.6 The Specifications

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

#### § 1.1.7 Instruments of Service

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

#### § 1.1.8 Initial Decision Maker

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

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

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

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

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

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

### § 1.3 Capitalization

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

### § 1.4 Interpretation

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

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

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

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

### § 1.6 Notice

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

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

### § 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–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 term "Owner" means the Owner or the Owner's authorized representative.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## ARTICLE 3 CONTRACTOR

### § 3.1 General

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

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

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

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

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

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

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

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

### § 3.3 Supervision and Construction Procedures

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

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

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

### § 3.4 Labor and Materials

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

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

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

### § 3.5 Warranty

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

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

### § 3.6 Taxes

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

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

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

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

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

### § 3.7.4 Concealed or Unknown Conditions

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

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

### § 3.8 Allowances

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

**§ 3.8.2** Unless otherwise provided in the Contract Documents,

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

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

### § 3.9 Superintendent

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

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

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

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

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

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

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

### § 3.11 Documents and Samples at the Site

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

delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

### § 3.13 Use of Site

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

### § 3.14 Cutting and Patching

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

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

### § 3.15 Cleaning Up

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

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

### § 3.16 Access to Work

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

### § 3.17 Royalties, Patents and Copyrights

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

### § 3.18 Indemnification

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

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

## ARTICLE 4 ARCHITECT

### § 4.1 General

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

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

### § 4.2 Administration of the Contract

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

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

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

### § 4.2.4 Communications

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

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

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

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

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

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

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

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

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

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

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

## ARTICLE 5 SUBCONTRACTORS

### § 5.1 Definitions

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

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

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

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

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

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

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

### § 5.3 Subcontractual Relations

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

### § 5.4 Contingent Assignment of Subcontracts

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

- **.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. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

## ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

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

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

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

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

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

### § 6.2 Mutual Responsibility

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

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

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

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

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

### § 6.3 Owner's Right to Clean Up

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

## ARTICLE 7 CHANGES IN THE WORK

### § 7.1 General

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

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

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

### § 7.2 Change Orders

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

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

### § 7.3 Construction Change Directives

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

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

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

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

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

.1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;

.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and

.5 Costs of supervision and field office personnel directly attributable to the change.

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

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

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

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

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

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

### § 7.4 Minor Changes in the Work

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

## ARTICLE 8 TIME

### § 8.1 Definitions

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

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

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

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

### § 8.2 Progress and Completion

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

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

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

### § 8.3 Delays and Extensions of Time

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

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

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

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

### § 9.3 Applications for Payment

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

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

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

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

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

### § 9.4 Certificates for Payment

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

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

### § 9.5 Decisions to Withhold Certification

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

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

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

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

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

**§ 9.6 Progress Payments**

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

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

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

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

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

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

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

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

### § 9.7 Failure of Payment

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

### § 9.8 Substantial Completion

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

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

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

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

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

### § 9.9 Partial Occupancy or Use

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

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

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

### § 9.10 Final Completion and Final Payment

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

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

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

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

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

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

## ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

### § 10.1 Safety Precautions and Programs

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

### § 10.2 Safety of Persons and Property

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

.1 employees on the Work and other persons who may be affected thereby;

.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and

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

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

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

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

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

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

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

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

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

**§ 10.3 Hazardous Materials and Substances**

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

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

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

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

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

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

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

### § 10.4 Emergencies

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

## ARTICLE 11 INSURANCE AND BONDS

### § 11.1 Contractor's Insurance and Bonds

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

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

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

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

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

**§ 11.2 Owner's Insurance**

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

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

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

**§ 11.3 Waivers of Subrogation**

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

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

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

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

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

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

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

## ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

**§ 12.1 Uncovering of Work**

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

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

**§ 12.2 Correction of Work**

**§ 12.2.1 Before Substantial Completion**

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

**§ 12.2.2 After Substantial Completion**

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

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

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

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

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

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

### § 12.3 Acceptance of Nonconforming Work

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

## ARTICLE 13 MISCELLANEOUS PROVISIONS

### § 13.1 Governing Law

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

### § 13.2 Successors and Assigns

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

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

### § 13.3 Rights and Remedies

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

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

### § 13.4 Tests and Inspections

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

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

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

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

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

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

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

### § 13.5 Interest

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

## 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;
- **.3** Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- **.4** The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

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

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

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

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

**§ 14.2.1** The Owner may terminate the Contract if the Contractor

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## ARTICLE 15 CLAIMS AND DISPUTES

### § 15.1 Claims

#### § 15.1.1 Definition

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

#### § 15.1.2 Time Limits on Claims

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

#### § 15.1.3 Notice of Claims

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

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

#### § 15.1.4 Continuing Contract Performance

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

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

#### § 15.1.5 Claims for Additional Cost

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

#### § 15.1.6 Claims for Additional Time

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

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

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

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

**.1** damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

**.2** damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

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

**§ 15.2 Initial Decision**

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

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

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

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

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

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

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

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

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

**§ 15.3 Mediation**

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

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

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

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

**§ 15.4 Arbitration**

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

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

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

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

**§ 15.4.4 Consolidation or Joinder**

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

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

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

## SECTION 00 73 00 - SUPPLEMENTARY GENERAL CONDITIONS

The following supplements modify, change, delete from or add to the "General Conditions of the Contract for Construction," AIA Document A201. Where any article of the General Conditions is modified or any paragraph, subparagraph or clause thereof is modified or deleted by these Supplementary Conditions, the unaltered provisions of that article, paragraph, subparagraph or clause shall remain in effect.

### ARTICLE 1 -- GENERAL PROVISIONS

### 1.1 BASIC DEFINITIONS

For further clarification of definitions refer to the following:

| | |
|---|---|
| Owner | Onslow County Schools |
| Architect | Smith Sinnett Architecture, P.A., or an official representative thereof. |
| Project Manual | The Project Manual is the volume generally referred to as the "Specifications" and consists of the bidding requirements, sample forms and certain Contract Documents such as the Conditions of the Contract, and the Specifications. |

### 1.1.3 THE WORK

Add the following sentence at the end of this section:

It also includes all supplies, skill, supervision, transportation services and other facilities and things necessary, proper or incidental to the carrying out and completion of the terms of the contract and all other items of cost or value needed to produce, construct and fully complete the public work identified by the Contract Documents.

### 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

Add the following Section:

**1.2.1.2** Relation of Specifications and Drawings: To be equivalent in authority and priority. Should they disagree in themselves, or with each other, prices shall be based on the most expensive combination of quality and quantity of Work indicated. In the event of the above mentioned disagreements, the resolution shall be determined by the Architect and Owner.

Add Section **1.9** as follows:

### 1.9 MISCELLANEOUS DEFINITIONS

### 1.9.1 ADDENDA, ADDENDUM

Documents issued by the Architect prior to execution of the Owner Contractor Agreement for this Project that modify or clarify the Proposal Documents. All addenda become a part of the Contract Documents.

### 1.9.2 ALTERNATE(S)

A separate amount stated on the Proposal Form which, if accepted by the Owner, will be added to or deducted from the Base Bid. If accepted, the work that corresponds to the alternate proposal will become part of the agreement between Owner and Contractor. Alternate proposals shall remain valid for the same period of time as the Base Proposal after receipt of proposals, regardless if an Owner Contractor Agreement has been executed.

### 1.9.3 BASE BID

The Contractor’s proposal for the Work, not including any Alternates.

### 1.9.4 DATE OF AGREEMENT

The date the Owner formally awards a Contract for Construction of the Work. This date will be inserted in the first page of the Agreement between Owner and Contractor and shall be referenced in Performance Bond and Payment Bond forms. See also Date of Commencement of Work.

### 1.9.5 DATE OF COMMENCEMENT OF THE WORK

The date of a written Notice to Proceed to the Contractor for a given portion of the Work. This date constitutes day zero (0) of the stated Contract Time. The Notice to Proceed will be issued after the District has received and validated the Contractor's Payment Bond, Performance Bond and Insurance.

### 1.9.6 NOTICE TO PROCEED

A notice that may be given by the Owner to the Contractor that directs the Contractor to start the Work. It may also establish the Date of Commencement of the Work.

### 1.9.7 PROVIDE

Whenever the word "provide" is used in these documents, it shall mean the same as "furnish and install".

### 1.9.8 PUNCH LIST

A comprehensive list prepared by the Contractor prior to Substantial Completion to establish all items to be completed or corrected; this list may be supplemented by the Architect or Owner. See AIA Document A201, Section 9.8.

### 1.9.9 UNIT PRICES

A cost for a unit of work as described in the Contract Documents. The Owner may add or deduct Unit Price work at the costs stated on the Proposal Form and such costs shall not be subject to additional mark up by the Contractor or his subcontractors."

## ARTICLE 2 – OWNER

### 2.1 GENERAL

Delete the text of Section **2.1.1** in its entirety and substitute the following:

**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. All parties understand that only the Governing Board for the Owner acting as a body corporate has the authority to bind the Owner with respect to all matters requiring the Board's approval under current policy of the Board for the Owner, including, but not limited to, Change Orders. Except as otherwise provided in Section 4.2.1, the Architect does not have authority to bind the Owner with respect to matters requiring the Owner's approval or authorization. The term "Owner" means the Owner or the Owner's authorized representative.

Delete the text of Section **2.1.2** in its entirely.

### 2.2 EVIDENCE OF THE OWNER'S FINANCIAL ARRANGEMENTS

After the first sentence of Section **2.2.1,** delete the remainder of Section **2.2.1** in its entirety. Delete

Sections **2.2.2** and **2.2.3** in their entirety.

### 2.3 INFORMATION AND SERVICES REQUIRED OF THE OWNER

Delete Section **2.3.6** in its entirety and replace it with the following:

**2.3.6** The Contractor will be furnished with electronic copies of the plans and specifications.

Add Section **2.6** as follows:

**2.6 OWNER'S LACK OF LIABILITY TO THIRD PARTY**

**2.6.1** The Owner is not responsible for the acts and/or omissions of, or contractually involved with, any subcontractors, suppliers of labor or materials, and/or their respective employees or agents or any other third-party claimants. Such claimants shall not constitute third party beneficiaries under this contract. The Contractor and/or his Surety solely shall deal with, take responsibility for, and be liable to such parties under this Contract. Contractor will indemnify and defend the Owner from any legal actions against Owner for unpaid bills of subcontractors.

**ARTICLE 3 -- CONTRACTOR**

**3.1 GENERAL**

Add Section **3.1.4** as follows:

**3.1.4** The Contractor must be fully qualified under any state or local licensing laws for Contractors in effect at the time and at the location of the work. The Contractor is responsible for determining that all of his subcontractors and prospective subcontractors are duly licensed in accordance with the law.

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

Delete the last sentence of Section **3.2.4** in its entirety and substitute the following:

If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities provided such errors, inconsistencies, omissions, differences, or nonconformities could not have been ascertained from a careful study of the Contract Documents.

Add Sections **3.2.5** and **3.2.6** as follows:

**3.2.5** The Contractor shall make a reasonable attempt to interpret the Contract Documents before asking the Architect for assistance in interpretation. The Contractor shall not ask the Architect for observation of work prior to the Contractor's field superintendent's personal inspection of the work and his determination that the work of all major subcontractors, to allow the subcontractor to demonstrate his understanding of the documents to the Architect and to allow the subcontractor to ask for any interpretation he may require.

**3.2.6** If, in the opinion of the Architect, the Contractor does not make a reasonable effort to comply with the above requirements of the Contract Documents and this causes the Architect or his Consultants to expend an unreasonable amount of time in the discharge of the duties imposed on him by the Contract Documents, then the Contractor shall bear the cost of compensation for the Architect's additional services made necessary by such failure. The Architect will give the Contractor prior notice of intent to bill for additional services related to Sections 3.2.5, 3.2.6 and 3.7 before additional services are performed.

**3.3 SUPERVISION AND CONSTRUCTION PROCEDURES**

Add Sections **3.3.4, 3.3.5, and 3.3.6** as follows:

**3.3.4** The Contractor is especially cautioned to coordinate the routing of mechanical and electrical items prior to commencing these operations.

**3.3.5** Contractor shall bear sole responsibilities for design and execution of acceptable trenching and shoring procedures. On trench excavations in excess of 4 feet in depth, Contractor shall pay a qualified engineer, experienced in the engineering design and preparation of drawings and specifications for compliance with state requirements for trenching and shoring, to prepare and professionally seal detailed drawings and specifications directing Contractor in the safe execution of trenching and shoring.

**3.3.6** Any time that the Contractors' 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 are on site, the work shall be supervised by a qualified employee of the Contractor.

### 3.4 LABOR AND MATERIALS

Delete Section **3.4.2** in its entirety and replace it with the following:

**3.4.2** The materials, products, and the systems covered by these specifications have been selected as a standard because of quality, particular suitability, or record of satisfactory performance. It is not intended to preclude the use of equivalent or better materials, products, or systems provided that same meets the requirements of the particular project and have been approved in an addendum as a substitution prior to the submission of bids. If prior written approval in an addendum has not been obtained, it will be assumed that the Bid is based upon the materials, products, and systems described in the Bidding Documents and no substitutions will be permitted, except as provided hereinafter.

**.1** After the Contract has been executed, the Owner and Architect will consider a formal request for the substitution of products on the Work in place of those specified only under the conditions set forth in specification referring to Product Options and Substitutions.

**.2** Requests for substitution, received by the Architect later than forty five (45) days after "Notice to Proceed" or "Date of Commencement of the Work" (whichever occurs first), may result in additional costs to the Owner. Contractor agrees to reimburse the Owner through deductive Change Order to the Contract, for all costs associated with such requests.

**.3** By making request for substitutions based on Subparagraph 3.4.2 above, the Contractor

**.1** represents that the Contractor has personally investigated the proposed substitute product and determined that it is equivalent or superior in all respects to that specified, and is suitable for the intended purpose;

**.2** represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified;

**.3** certifies that the cost data presented is complete and includes all related costs under this Contract except the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and

**.4** will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.

**.5** Substitution requests shall be submitted on the forms included herein and in accordance with the process established in specification referring to Product Options and Substitutions.

Add the following Sections after Section **3.4.3:**

**3.4.3** **.1** State law prohibits possession and/or use of alcohol and tobacco products on school property at all times.

**.2** State law prohibits weapons or firearms on school property.

**.3** There shall be zero tolerance for fraternization with students, teachers and any other school district personnel, Contractor will immediately remove any employee that violates this provision from the project.

**.4** No glass bottles shall be brought on the construction site or Owner's property by any construction personnel.

**.5** The Contractor shall provide criminal background checks for all personnel occupying the construction site.

### 3.5 WARRANTY

Add Sections **3.5.3, 3.5.4** and **3.5.5** as follows:

**3.5.3** In the event of failure in the Work, including a specified product, whether during construction, or the correction period (which shall be one (1) year from the Date of Substantial Completion, except where a longer period as specified), the Contractor shall take prompt and appropriate measures to assure correction or replacement of the defective Work or any portion thereof, including manufactured products, whether notified by the Owner or the Architect. Upon correction of warranty items, the Contractor shall provide the Owner and Architect with written notification of said correction. This obligation shall survive acceptance of the Work under the Construction Contract.

**3.5.4** The Contractual Correction Period for this Project is one (1) year from the date of Substantial Completion, except for any extended warranties as specified within the Contract Documents. Items of Work not completed until after

the deadline for Substantial Completions shall have their warranties (general and any extended warranty periods) extended by the period of time between the deadline for Substantial Completion and the actual completion of the Work. Such warranties shall be submitted to the Owner in writing, documenting such time extensions. This correction period shall not restrict or modify extended warranties called for or provided on systems, equipment or other specific portions of the Work.

**3.5.5** The Contractor shall accompany the Owner and Architect for a complete reinspection of the Project approximately eleven (11) months after the Date of Substantial Completion and shall promptly complete any observed or reported deficiencies in the Work, including any uncompleted Punch List items or outstanding and incomplete warranty items. The contractor shall provide written notification to the Owner and Architect when said Punch List items and/or additional deficiencies observed have been corrected. This obligation shall survive acceptance of the Work under the Construction Contract.

### 3.6 TAXES

Add the following sentence to the end of **3.6**:

The contractor shall provide a sales tax report with each Application for Payment. The sales tax report will report all taxes paid on materials and goods that are included in the Application for Payment for the period covered in the application. The Form of Sales Tax Report is to be preapproved by the Owner and Architect.

### 3.8 ALLOWANCES

Delete Section **3.8.1** in its entirety and substitute the following:

**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 and approve in writing. All unused allowance amounts shall be credited back to Owner, along with any markups included in the Contract Sum on such unused amounts.

### 3.9 SUPERINTENDENT

Delete Section 3.9.1 in its entirety and substitute the following:

**3.9.1** The Contractor shall employ a competent superintendent, project manager and necessary assistants who shall be in attendance at the Project site during performance of the Work, including Punch List work. The superintendent and project manager shall represent the Contractor, and unless provided otherwise in Section 3.1.1, communications given to the superintendent or project manager shall be binding as if given to the Contractor.

### 3.10 CONTRACTOR'S CONSTRUCTION AND SUBMITTAL SCHEDULES

Add the following clause to Section **3.10.1**:

The schedule shall clearly define the critical path through the project.

Add the following clause to Section **3.10.2**:

**3.10.2** 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 the Contract Sum or extension of the Contract Time based on the time required for review of submittals.

Add Section **3.10.4** as follows:

**3.10.4** The Contractor shall submit to the Architect, with each monthly Application for Payment; a copy of the progress schedule updated to reflect the current status of the project. The Contractor shall take whatever action necessary to assure that the project completion schedule is met.

### 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

At Section **3.12.5**, add the following Sections:

**3.12.5** **.1** If, in the opinion of the Architect, the Shop Drawings, Product Data, Samples and similar submittals are incomplete, indicate an inadequate understanding of the work covered by the submittals, or indicate a lack of study and review by the Contractor prior to submittal to the Architect, the submittals will be

returned, unchecked, to the Contractor for correction of these three deficiencies and subsequent resubmittal. Additional service charges as outlined in 3.2.6 may be charged by the Architect in this event.

**.2** The Architect will take no action on Shop Drawings, Product Data, and Samples that have not first been certified, by stamped, signed notation, as having been checked and approved by the Contractor for use in the Work, or that are not specifically required by the Contract Documents.

At Section **3.12.7**, correct the word "approved" in the last line to read "accepted".

Add Section **3.12.7.1** as follows:

**3.12.7.1** No submittal involving the selection of a color, material, texture, or pattern will be released until all such selections are approved by the Owner.

At Section **3.12.8**, correct "Architect's approval" in the last line to read "Architect's acceptance".

At Section **3.12.9**, correct "Architect's approval" in the last line to read "Architect's acceptance" and add the following Section:

**3.12.9.1** Deviation from the requirements of the Contract Documents indicated on shop Drawings, Product Data, and Samples, does not constitute the required notification "in writing.

Add Sections **3.12.11** and **3.12.12** as follows:

**3.12.11** The Contractor shall submit digital PDF's of Shop Drawings, Product Data, and similar submittals in the proper format according to the procedures stipulated within the Contract Documents. Digitally submitted Shop Drawings will be reviewed and marked by the Architect and/or his consultants and returned to the Contractor for his use, distribution, correction or resubmittal as required. Contractor corrections or revisions shall be resubmitted to the Architect in accordance with same procedures. The digitally marked up prints will be retained by the Architect and his consultants. Samples shall be submitted directly to the Architect for review.

**3.12.12** The Contractor shall provide MEP coordination drawings within a schedule mutually agreed upon by the Team and prior to installing the Work, showing how all piping, ductwork, lights, conduit, equipment, etc. will fit into the ceiling space allotted, including clearances required by the manufacturer, by code, or in keeping with good construction practice. Space for all trade elements must be considered on the same drawing. Drawings shall be at 1/8 inch per foot minimum scale and shall include invert elevations and sections required to meeting intended purpose. The Contractor may propose an alternate method of accomplishing MEP coordination. If the alternate method is approved by the Team, it may be utilized.

### 3.15 CLEANING UP

Add Section **3.15.3** as follows:

**3.15.3** Prior to the Architect's inspection for Substantial Completion the Contractor shall clean exterior and interior surfaces exposed to view; remove temporary labels, stains, and foreign substances; polish transparent and glossy surfaces; clean equipment and fixtures to a sanitary condition; replace air filters in mechanical equipment; clean roof, gutters, and downspouts; remove obstructions and flush debris from drainage systems; clean site; sweep paved areas and rake clean other surfaces; remove trash and surplus materials from the site.

Add Sections **3.19** and **3.20** as follows:

### 3.19 ANTITRUST VIOLATIONS

**3.19.1** Contractor hereby assigns to Owner any and all claims for overcharges associated with this Contract which arise under the antitrust laws of the United States, 15 U.S.C.A. Section 1 et.seq. (1973). The Contractor shall include this provision in his contracts with each Subcontractor and Supplier. Each Subcontractor shall include such provision in contracts with Sub-subcontractors and suppliers.

### 3.20 THIRD-PARTY BENEFICIARY

**3.20.1** No person or entity shall be deemed to be a third-party beneficiary of any provision(s) of this Contract; nor shall any provision(s) hereof be interpreted to create a right of action or otherwise permit anyone not a signatory party to the Contract to maintain an action for personal injury or property damage.

## ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

**Clarification:** References to "separate contractors" and "separate contracts" do not apply to the Prime Contract of the Work covered in this Project Manual or Drawings, but only to other contractors or other contracts undertaken by the Owner prior to, concurrent with, or subsequent to the Work of this Project. The Work of the Prime Contractor bidding on and constructing this Project are not considered "separate contractors" or separate contracts" as identified in this Article.

The Owner has no responsibility to coordinate the work or activities of the Prime Contractor on this Project, but only to coordinate the work of his own forces or his "separate contractors" with the Prime Contractor for this Project.

## ARTICLE 7 -- CHANGES IN THE WORK

### 7.1 GENERAL

Delete the text of Section **7.1.2** in its entirety and substitute the following:

**7.1.2** A Change Order shall be based on agreement among the Owner, Contractor, and Architect, except when the Contract balance is amended as a result of Owner's Right to Carry out the Work under Section 2.4.1 or the Owner's assessment of liquidated damages as allowed by the Contract Documents. A Construction Change Directive requires agreement by the Owner or the Owner's representative and Architect, and may or may not be agreed to by the Contractor; an order for a minor change may be issued by the Architect alone.

## ARTICLE 8 – TIME

### 8.2 PROGRESS AND COMPLETION

Add the following Clauses **8.2.3.1** and **8.2.3.2** to Subparagraph **8.2.3**:

**8.2.3.1** The Contract time shall commence on a date to be specified in a written Notice to Proceed from the Architect, anticipated on or about May 10th, 2024. Substantial Completion on or before the dates listed below
**Phase 1 (Gymnasium and Canopy) – Substantial on or before June 1, 2025.**
**Phase 2 (Renovations and all site work) – Substantial on or before December 1, 2025.**

**8.2.3.2** Final Completion shall occur on or before 30 days after substantial completion.

### 8.3 DELAYS AND EXTENSIONS OF TIME

Add the following Clause **8.3.1.1**to Subparagraph **8.3.1**:

**8.3.1.1** On any day that the Contractor considers that the Project is delayed by adverse weather conditions, the Contractor shall identify in writing to the Architect and the Owner the adverse weather conditions affecting each activity, the specific nature of the activity affected, the number of hours lost, and the number of and identity (by responsibility or trade) of workers affected and shall obtain from the Architect written recognition of the delay. The time for performance of this Contract includes an allowance for a number of calendar days which may not be suitable for construction Work by reason of adverse weather. The Contract Time will be extended only if the number of calendar days of adverse weather recognized by the Architect exceeds the number of inclement weather days set forth below, and the Contractor demonstrates how this adverse weather impacts activities on the critical path of the Contract Construction Schedule.

| Month | Number of Inclement Weather Days |
|---|---|
| January | 8 |
| February | 8 |
| March | 8 |
| April | 7 |
| May | 8 |
| June | 7 |

| | |
|---|---|
| July | 9 |
| August | 8 |
| September | 6 |
| October | 6 |
| November | 6 |
| December | 7 |

**ARTICLE 9 -- PAYMENTS AND COMPLETION**

**9.2 SCHEDULE OF VALUES**

Add the following Sections:

**9.2.1** Schedule of Values shall break each line into materials and labor. Once approved by the Owner and Architect, it shall be used as basis for reviewing Application for Payment but not be taken as evidence of market or other value.

**9.2.2** Contractor's cost for various construction items shall be detailed. For example, concrete work shall be subdivided into footings, grade beams, floor slabs, paving, etc. These subdivisions shall appear as individual line items**.**

**9.2.3** On major subcontracts, such as mechanical, electrical, and plumbing, the Schedule shall indicated line items and amounts in detail, (for example; underground, major equipment, fixtures, installation of fixtures, start up, etc.)

**9.2.4** Costs for subcontract work shall be listed without any addition of General Contractor's costs for overhead, profit or supervision.

**9.2.5** The Contractor shall include a value for the coordination documents/drawings on the schedule of values.

**9.2.6** The Contractor shall include a value for the correction of deficiencies noted by the Commissioning Agent and the Test, Adjust and Balance consultant on the schedule of values for each sub-contractor subject to commissioning and test, adjust and balancerequirements.

**9.3 APPLICATIONS FOR PAYMENT**

Add the following sentence to Subparagraph **9.3.1**:

The form of Application for payment shall be a notarized AIA Document G702, Application and Certification for Payment, supported by AIA Document G703, Continuation Sheet. Certificate of Release of Liens shall be submitted with each pay application. A reasonable facsimile of these AIA documents may be used provided they have been preapproved by the Architect.

Add the following to Subparagraph **9.3.1:**

Until Substantial Completion, the Owner will pay 95% of the amount due the Contractor on account of progress payments. After the Work is 50% complete, if the manner of completion of the Work and its progress are and remain satisfactory to the Owner and Architect, and in the absence of other good and sufficient reasons, retainage may be held at 5% of the total Contract and the Architect may authorize remaining partial payments to be paid in full.

The full Contract retainage may be reinstated if the manner of completion of the Work and its progress do not remain satisfactory to the Owner and Architect, or if the Surety withholds its consent, or for other good and sufficient reasons.

Delete Section **9.3.2** in its entirety and replace with the following:

**9.3.2** Payments will be made on account of materials or equipment 1) incorporated in the Work; 2) suitably stored at the site; or 3) suitably stored at some off-site location, provided the following conditions are met for off-site storage:

**.1** The location must be agreed to, in writing, by the Owner and Surety.

**.2** The location must be a bonded warehouse suitably conditioned for the storage of the material or goods.

**.3** Surety must agree, in writing, to each request for payment.

**.4** The Contractor must bear the cost of the Owner's and Architect's expenses related to visiting the offsite storage area for confirmation.

Responsibility for such stored materials and equipment shall remain with the Contractor regardless of ownership title. Payments for materials or equipment stored on or off the site shall be conditioned upon submission by the Contractor of bills of sale or such other procedures satisfactory to the Owner to establish the Owner's title to such materials or equipment or otherwise protect the Owner's interest, including applicable insurance insured) and transportation (naming the Owner as to the site for those materials and equipment stored off the site. Under no circumstances will the Owner reimburse the Contractor for down payments, deposits, or other advance payments for materials or equipment, without prior written approval of Owner.

The Contractor acknowledges that the review of materials and/or equipment stored off the side is an additional service of the Architect, and the Contractor shall be charged for that service. The cost for such service will be established by the Architect and is not subject to appeal.

**9.7 FAILURE OF PAYMENT**

Delete the phrase "or awarded by binding dispute resolution." Replace all references to "seven days" to "ten days."

**9.8 SUBSTANTIAL COMPLETION**

At Section **9.8.2**, add the following sentence at the end:

Should the Architect determine that the Contractor's List of Items to be Completed or Corrected lacks sufficient detail or requires extensive supplementation, the list will be returned to the Contractor for revision, and inspection for determining the Date of Substantial Completion will be delayed until the List submitted is a reasonable representation of the work to be done.

Add the following sentence to Subparagraph **9.8.3:**

The payment shall be sufficient to increase the total payments to 95% of the Contract Sum, less such amounts as the Architect shall determine for incomplete Work and unsettled claims.

Add Sections **9.8.6** as follows:

**9.8.6** In order for the project or a major portion thereof to be considered substantially complete, the following conditions must be met:

**.1** All inspections by governmental authorities having jurisdiction over the project must have been finalized, any remedial work required by those authorities must have been completed, and Certificates of Occupancy and similar governmental approval forms must have been issued and copies delivered to the Owner and Architect.

**.2** All work, both interior and exterior, shall have been completed and cleaned except minor items which if completed after occupancy, will not, in the Owner's opinion, cause interference to the Owner's use of the building or any portion thereof. A significantly large number of items to be completed or corrected will preclude the Architect from issuing a Certificate of Substantial Completion. The Owner and Architect will be the sole judge of what constitutes a significantly large number of items.

**.3** The following items are a partial specific list of requirements, as applicable to the Project, that must be completed prior to established Substantial Completion of all portions of the work (Including the Substantial Completion of the commissioning phase).

1. All fire alarm system components must be completed and demonstrated to the Owner.
2. Local fire marshal approval certificate, or similar Certificate of Occupancy from the governing agency, must be delivered to the Owner.
3. All exterior clean-up and landscaping must be complete.
4. All final interior clean-up must be complete.
5. All HVAC air and water balancing must be complete.

6. All required commissioning must be complete.
7. All Energy Management Systems must be complete and fully operational and demonstrated to the Owner.
8. All communications equipment, telephone system, and P.A. systems must be complete and demonstrated to the Owner.
9. All final lockset cores must be installed and all final Owner directed keying completed.
10. All room plaques and exterior signage must be completed.
11. All Owner demonstrations must be completed including kitchen equipment, HVAC equipment, plumbing equipment, and electrical equipment.

**9.10 FINAL COMPLETION AND FINAL PAYMENT**

At Section **9.10.2**, add the following sentence at the end:

Prior to final payment, the Contractor shall meet all of the requirements the Closeout Procedures.

Add Section **9.11** as follows:

**9.11 LIQUIDATED DAMAGES**

**9.11.1** The Contractor and the Contractor's surety's shall be liable for and shall pay the Owner the sum noted below, herein stipulated as liquidated damages, for each calendar day of delay until the Work is substantially complete. Dates for Substantial Completion based on 8.3.2.1.

A. Liquidated Damages Phase 1 - One Thousand Dollars and no Cents ($1,000.00) per day.
B. Liquidated Damages Phase 2 – Five Hundred Dollars and no Cents ($500.00) per day.

**9.11.2** Time for Completion of final inspection items after Substantial Completion shall be thirty (30) Days after final inspection list is received by the Contractor. After thirty (30) days, upon seven (7) days written notice, the Owner shall have the option to correct or conclude any and all final inspection items not completed by the Contractor to the satisfaction of the Architect and the Owner within thirty (30) days from the actual date of substantial completion by utilizing its own forces or hiring others. The cost of correcting such remaining final inspection items by the Owner or others shall be deducted from the final payment to the Contractor.
For each consecutive calendar day that the Work remains incomplete after the date established for Final Completion, the Owner will retain from compensation otherwise to be paid to the Contractor the sum of **Five Hundred ($500.00).** This amount is the minimum measure of damages the Owner will sustain by failure of the Contractor to complete all remedial work, correct deficient work, clean up the project and other miscellaneous tasks as required to complete all work specified. This amount is separate from the liquidated damages prescribed above under paragraph 9.11.

**ARTICLE 10 -- PROTECTION OF PERSONS AND PROPERTY**

Add Section **10.2.9**:

**10.2.9** The Contractor shall be responsible for taking all precautions necessary to protect the Work in place from any foreseeable weather conditions which could cause any potential damage to portions or all Work in place. The Contractor shall be responsible for performing all repairs and/or replacement of any Work that results from foreseeable weather conditions.

**ARTICLE 11 -- INSURANCE AND BONDS**

Delete the text of Sections 11.1 through 11.5 and substitute the following Sections:

**11.1 CONTRACTOR'S LIABILITY INSURANCE**

The Owner reserves the right to review the insurance requirements during the effective period of any Contract to make reasonable adjustments to insurance coverages and limits when deemed reasonably prudent by Owner based upon changes in statutory laws, court decisions or potential increase in expense to loss.

**11.2** The Owner requires the following minimum insurance coverages:

| Types of Coverage | Limits of Liability | |
|---|---|---|
| Commercial General Liability | General Aggregate | $2,000,000.00 |
| | Products/Completed Operations/Aggregate | $1,000,000.00 |
| | Bodily Injury and Property Damage (each) | $1,000,000.00 |
| | Contractual | $1,000,000.00 |
| | Personal and Advertising Injury | $1,000,000.00 |
| | Fire Damage | $500,000.00 |
| | Medical Expense | $5,000.00 |

**11.2.1** The Owner shall be named as an additional insured on a primary and non-contributory basis using form CG 2010 10 01 or similar endorsement providing equal or greater coverage in favor of the Owner.

Coverage shall include the following:
(a) Premises operations;
(b) Blanket Contractual Liability;
(c) Pollution;
(d) Products/Completed Operations;
(e) Broad Form Property Damage;
(f) Independent Contractors;
(g) Per project aggregate limit;
(h) Provide a statement of claims against the aggregate limit with each renewal certificate;
(i) X,C,U exclusions to be removed when underground work is performed; and
(j) Waivers of subrogation in favor of Owner and its officers, directors, representatives, agents and employees shall be provided.

**11.2.2** Automobile Liability — Combined Single Limit — $1,000,000.00

(a) Comprehensive Automobile Liability Insurance to cover all vehicles owned by, hired by, or used on behalf of Contractor.

(b) Owner and its officers, directors, representatives, agents and employees shall be endorsed as Additional Insureds, as their interests may appear.

(c) Waivers of subrogation in favor of Owner and its officers, directors, representatives, agents and employees shall be provided.

**11.2.3** Workers' Compensation — Statutory Limits

(a) Coverage at Statutory Limits with All States Endorsement

| | | |
|---|---|---|
| (b) Employer's Liability | Each Accident | $1,000,000.00 |
| | Disease (Policy Limit) | $1,000,000.00 |
| | Disease (Each Employee) | $1,000,000.00 |

(c) Waivers of subrogation in favor of Owner and its officers, directors, representatives, agents and employees shall be provided.

**11.2.4** Excess or Umbrella Insurance (provides coverage in excess of primary Commercial General Liability, Automobile Liability, and Worker's Compensation Coverage Blimits)

(a) Minimum coverage for the Contractor shall be one (1) times the Contract amount, subject to a minimum limit of $1,000,000.00 and a maximum limit of $25,000,000.00. Limits for primary policies may differ from those shown above when Excess (Umbrella) Insurance coverage is provided.

(b) Owner and its officers, directors, representatives, agents and employees shall be endorsed as Additional Insureds, as their interests may appear.

(c) Waivers of subrogation in favor of Owner and its officers, directors, representatives, agents and employees shall be provided.

**11.2.5** Builder's Risk

Unless otherwise directed by Owner, Contractor shall purchase and maintain property insurance written on its "builder's risk 'all risk'" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained until such time as provided for in Section 11.3. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project. Such insurance, being on an "all-risk" or equivalent policy form shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, hail, tornado, storm, flood, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss. Such insurance shall cover portions of the Work stored off site and portions of the Work in transit.

**11.3** The following insurance requirements shall be satisfied:

.1 No Work shall be commenced until all insurance requirements set forth in this Agreement have been approved by the Owner in writing.

.2 All insurance policies and certificates required hereunder shall be in form and content satisfactory to the Owner.

.3 The Owner shall be furnished an ACORD form Certificate of Insurance evidencing all policies and endorsements required by this Agreement prior to execution of the Contract and thereafter upon renewal or replacement of each required policy of insurance.

.4 Each Insurance coverage/policy shall contain a provision that at least thirty (30) days prior written notice shall be given to the Owner in the event of cancellation, material change, or non- renewal.

.5 Insurance shall be underwritten by a company licensed to do business in North Carolina, satisfactory to Owner and rated minimum A-VII by A.M. Best.

.6 The insurance coverages specified herein shall be maintained at all times during the term of the contract and, with the exception of builder's risk coverage, shall be maintained for a minimum of one (1) year thereafter.

.7 No deletions/exclusions from the standard coverage form are allowed without the prior written consent of the Owner.

.8 All insurance must be issued on an occurrence basis.

.9 The Contractor shall be responsible for all deductibles; the Owner shall approve the deductibles selected.

.10 With the exception of Excess Umbrella Coverage, the coverage afforded by each carrier must be a primary over any other applicable insurance.

.11 In addition to certificates of insurance, copies of policy endorsements must be provided (a) listing the

Owner as Additional Insured, and (b) showing waivers of subrogation in favor of the Owner.

**11.4 PERFORMANCE BOND AND PAYMENT BOND**

Add the following Sections:

**11.4.1** The Contractor shall provide a Performance Bond, in the penal sum equal to one hundred percent (100%) of the Contract Sum, if the formal Contract is in excess of One Hundred Thousand Dollars ($100,000.00) and a Labor and Material Payment bond, in the penal sum equal to one hundred percent (100%) of the Contract sum.

**11.4.2** The Work will not be started until the bonds and issuing companies have been accepted as satisfactory by the Owner. The original bonds will be delivered to the Owner with an attached authorized power of attorney. Such Bonds shall be issued by a company authorized to do business in North Carolina with an A.M. Best Company rating of a least A-X and included on the U.S. Department of the Treasury Listing of Approved Sureties (Dept. Circular 570).

**11.4.3** The Performance Bond Form and the Payment Bond Form included herein shall be executed and submitted to the Architect in duplicate prior to commencement of the work.

**11.4.4** Each bond shall be of penal sum equal to one hundred percent (100%) of the Contract Sum and shall be compatible with the provisions of the governing authority. The bonds shall remain in force throughout the warranty period of the contract. The Work will not be started until the bonds and issuing companies have been accepted as satisfactory by the Owner. The original bonds will be delivered to the Owner with an authorized power of attorney attached.

**ARTICLE 12—UNCOVERING AND CORRECTION OF WORK**

**12.2.1 BEFORE SUBSTANTIAL COMPLETION**

After Section **12.2.1** add the following Sections:

**12.2.1.1** In the event of failure of a specified product, either during construction or the correction period, the Contractor shall take appropriate measures with the manufacturer of the product to assure correction or replacement of the defective products.

**12.2.1.2** Refer to Closeout Procedures in the specifications for further terms regarding warranties which will be required prior to final payment.

**12.2.2 AFTER SUBSTANTIAL COMPLETION**

After Section **12.2.2** add the following Section:

**12.2.2.1** Approximately eleven months after substantial completion, the contractor shall accompany the Owner and Architect on an “end of the one year correction period” reinspection of the Project. Additional deficiencies observed or reported shall be corrected by the Contractor.

**12.3 ACCEPTANCE OF NONCONFORMING WORK**

Number the existing provision as Section **12.3.1**, and add Section **12.3.2** as follows:

**12.3.2** The Owner’s use and/or occupancy of any or all of the Project site shall never be construed as an acceptance of Work not in conformance with Contract Documents. The Owner reserves the right to enforce provisions of the Contract unless the Owner’s acceptance is provided to the Contractor in writing.

**ARTICLE 14—TERMINATION OR SUSPENSION OF THE CONTRACT**

Delete the text of Section 14.1.3 in its entirety and substitute the following:

**14.1.3** If one of the reasons described in Section 14.4.1 or 14.4.2 exists, the Contractor may, upon seven day’s written notice to the Ower and Architect, terminate the Contract and recover from the Owner payment for Work executed as of the date of the notice, plus costs of demobilization.

**14.4 TERMINATION BY THE OWNER FOR CONVENIENCE**

Delete the text of Section **14.4.3** in its entirety and substitute the following:

**14.4.3** In the case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed up to date of receipt of the notice of termination, plus costs of demobilization.

**ARTICLE 15—CLAIMS AND DISPUTES**

**15.1.7 CLAIMS FOR CONSEQUENTIAL DAMAGES**

Delete the text of Section **15.1.7** in its entirety.

**15.2 INITIAL DECISION**

Delete the text of Section **15.2.1** in its entirety and substitute the following:

**15.2.1** Claims, excluding those alleging an error or omission by the Architect or those arising after expiration of the period for correction of the Work, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. If the parties are unable to agree, any claim, dispute or matters arising out of the contract between the Architect, Owner and Contractor or any combination of those parties shall be submitted to a court of appropriate jurisdiction.

Delete the text of Section **15.2.5** in its entirety and substitute the following:

**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 therefore; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties, but subject to mediation, if both parties so agree, and subject to legal or equitable proceedings in a court having jurisdiction thereof. It is understood and agreed that, in the event that any dispute, controversy, or conflict arises during the design and construction of the Project or following its completion, the parties hereto will cooperate in good faith, if possible, to resolve the issues without resorting to litigation.

**15.3 MEDIATION**

**15.3.1** Delete the text of **15.3.1** in its entirety.

Delete Section **15.3.2** in its entirety and replace with the following:

**15.3.2** The parties may mutually agree to resolve their claims by mediation which, unless the parties mutually agree otherwise, shall be in accordance with the Construction Industry Mediation Rules of the American Arbitration Association currently in effect. Request for mediation shall be filed in writing with the other party to the Contract. Mediation shall proceed in advance of legal or equitable proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing unless stayed for a longer period of agreement of the parties or court order.

**15.4 ARBITRATION**

Delete the text of Sections **15.4.1** through **15.4.3** and **15.4.4.1** through **15.4.4.3** in their entirety.

**END OF DOCUMENT**

# AIA® Document A101® – 2017

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

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

**BETWEEN** the Owner:
*(Name, legal status, address and other information)*
Onslow County Board of Education
200 Broadhurst Road
Jacksonville, North Carolina 28540

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

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

Northwoods Park Middle School Gymnasium and Renovation
904 Sioux Drive
Jacksonville, North Carolina 28540
Add Gymnasium facilities and renovate existing Gym to Classrooms. May include several additional classrooms.

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

Smith Sinnett Architecture, P.A.
4600 Lake Boone Trail, Suite 205
Raleigh, North Carolina 27607

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.

The parties should complete A101®–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201®–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

**TABLE OF ARTICLES**



## ARTICLE 1 THE CONTRACT DOCUMENTS

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

## ARTICLE 2 THE WORK OF THIS CONTRACT

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

## ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

**§ 3.1** The date of commencement of the Work shall be:
*(Check one of the following boxes.)*

[ ] The date of this Agreement.

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

[ ] Established as follows:
*(Insert a date or a means to determine the date of commencement of the Work.)*

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

**§ 3.3.1** Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:
*(Check one of the following boxes and complete the necessary information.)*

[ ] Not later than ( ) calendar days from the date of commencement of the Work.

[ ] By the following date:

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

| Portion of Work | Substantial Completion Date |
|---|---|

**§ 3.3.3** If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

## ARTICLE 4 CONTRACT SUM

**§ 4.1** The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be ($ ), subject to additions and deductions as provided in the Contract Documents.

### § 4.2 Alternates

**§ 4.2.1** Alternates, if any, included in the Contract Sum:

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

**§ 4.2.2** 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 |
|---|---|---|

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

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

**§ 4.4** 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) |
|---|---|---|

**§ 4.5** Liquidated damages, if any:
*(Insert terms and conditions for liquidated damages, if any.)*

**§ 4.6** Other:
*(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)*

## ARTICLE 5 PAYMENTS

### § 5.1 Progress Payments

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

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

**§ 5.1.3** Provided that an Application for Payment is received by the Architect not later than the day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the day of the month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than ( ) days after the Architect receives the Application for Payment. *(Federal, state or local laws may require payment within a certain period of time.)*

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

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

**§ 5.1.6** In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

**§ 5.1.6.1** 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.

**§ 5.1.6.2** 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 A201–2017;
- **.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 A201–2017; and
- **.5** Retainage withheld pursuant to Section 5.1.7.

### § 5.1.7 Retainage

**§ 5.1.7.1** For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:
*(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:
*(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)*

**§ 5.1.7.2** Reduction or limitation of retainage, if any, shall be as follows:
*(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)*

**§ 5.1.7.3** Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, 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. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
*(Insert any other conditions for release of retainage upon Substantial Completion.)*

**§ 5.1.8** If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

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

**§ 5.2 Final Payment**

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

**.1** the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and

**.2** a final Certificate for Payment has been issued by the Architect.

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

**§ 5.3 Interest**

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

%

## ARTICLE 6 DISPUTE RESOLUTION

**§ 6.1 Initial Decision Maker**

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the 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 A201–2017, the method of binding dispute resolution shall be as follows:
*(Check the appropriate box.)*

[ ] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

[ ] Litigation in a court of competent jurisdiction

[ ] Other *(Specify)*

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** The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

**§ 7.1.1** If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:
*(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)*

**§ 7.2** The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

## ARTICLE 8 MISCELLANEOUS PROVISIONS

**§ 8.1** Where reference is made in this Agreement to a provision of AIA Document A201–2017 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)*

**§ 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 as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, and elsewhere in the Contract Documents.

**§ 8.5.2** The Contractor shall provide bonds as set forth in the Contract Documents.

**§ 8.6** Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, 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.)*

**§ 8.7** Other provisions:

**ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS**

**§ 9.1** This Agreement is comprised of the following documents:

**.1** AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor

**.2** AIA Document A101™–2017, Exhibit A, Insurance and Bonds

**.3** AIA Document A201™–2017, General Conditions of the Contract for Construction

**.4** AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
*(Insert the date of the E203-2013 incorporated into this Agreement.)*

**.5** Drawings

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

**.6** Specifications

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

**.7** 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.

**.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 incorporated into this Agreement.)*

[ ] The Sustainability Plan:

| Title | Date | Pages |
|---|---|---|

[ ] Supplementary and other Conditions of the Contract:

| Document | Title | Date | Pages |
|---|---|---|---|

**.9** Other documents, if any, listed below:
*(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 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.)*

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

| | |
|---|---|
| **OWNER** *(Signature)* | **CONTRACTOR** *(Signature)* |
| *(Printed name and title)* | *(Printed name and title)* |

## SECTION 00 90 10 - SPECIAL CONDITIONS

The following requirements are, in fact, Conditions of the Contract, and are in addition to the General Conditions, Supplementary General Conditions and Special Conditions and are not intended to replace or otherwise conflict with those Conditions. These Special Requirements are particular to the Work of this Project and are intended to inform the Contractor of non-standard conditions affecting the Work of the Contract.

### ARTICLE 1 - QUALIFICATION OF PROJECT SUPERINTENDENT

The Contractor shall be required to demonstrate his capability to provide a qualified project superintendent for the project who is acceptable to the Owner and Architect. The project superintendent shall have at least five years of successful experience on projects of similar size, scope and nature. Contractor shall be required to substantiate these qualifications with a written submittal within seven calendar days after opening of the Bids. The Contractor is charged with providing a qualified and experienced superintendent for this project to the satisfaction of the Owner and Architect. The Owner reserves the right to disapprove a proposed superintendent who does not appear to be fully qualified and experienced to accomplish the work of this project.

### ARTICLE 2 - SINGLE PRIME AND SEPARATE PRIME CONTRACT BIDS

Bids will be received for Single Prime Contracts only. Opening of Bids, as it relates to the number of bids required to allow opening, and award of Contracts, as it relates to low bid and the number of bids required to allow award, shall be governed by the guidelines and procedures recommended by the State Department of Construction of the N.C. Department of Administration for bid openings for single prime informal contract bids.

Those Bidders submitting Single Prime Contract bids shall be aware that all work of the project is included in the Work of a Single Prime Contractor, regardless of the divisions of work indicated on the Drawings and in the Project Manual. All references and indications in the Drawings and the Project Manual to Separate Prime Contracts shall apply to the Single Prime Contract.

Single Prime Contract Bidders must include the names of their major subcontractors on the Proposal form as indicated, to include Plumbing and Electrical.

Bid Alternates and Unit Prices identified shall be bid, as identified, by the Single Prime Contract Bidder, as indicated on the Proposal form.

All Allowances identified shall all be included in the Single Prime Contract Bid.

### ARTICLE 3 - COORDINATION AND COOPERATION WITH OTHER CONTRACTORS

Prime Contractor shall be aware that the Owner has or may engage other contractors to accomplish work concurrently with the Work of this project, which will have a direct effect on the accomplishment of the Work of this project. Contractors will be required to cooperate and coordinate with these other contractors during the course of the project to avoid delays in the work of this project of that of the other contractors.

### ARTICLE 4 – RESERVED

### ARTICLE 5 - UNDERGROUND SERVICES

Prime Contractor and all subcontractors shall field locate all underground services whether shown on drawings or not, including, but not limited to the following: utilities, underground wire, fiber optic lines, cable, conduit, and pipe, prior to initiating any excavation on any area of the proposed site. Provide and pay for underground utility locator service, metal detectors and hand digging as necessary to satisfy above requirements. Prime Contractor (s) and their subcontractors shall be responsible for utility services damaged during construction and shall repair at their own expense any utility services damaged by their work. Repairs shall be completed within 24 hours or less.

**ARTICLE 6 - AMERICANS WITH DISABILITIES ACT (ADA)**

It is the design intent of this project to comply with the Americans with Disabilities Act and Chapter 11 of the North Carolina Building Code 2012 and ANSI ICC A117.1-2009. All items and assemblies manufactured or fabricated for installation on this project shall be ADA compliant. Shop drawing submittals shall indicate ADA compliance. Installation of all items and assemblies shall be ADA compliant. All contractors shall submit a statement that all work to the best of their knowledge is ADA compliant prior to release of final retainage. Remedy of non-compliant circumstances should they arise shall consist of written notification to the Architect by the Contractor prior installation or fabrication of the respective building component or arrangement. Should any contractor, subcontractor, or regulatory authority having jurisdiction become aware of any non-compliant circumstance he shall notify the Architect at once.

**ARTICLE 7 - RESTRICTIONS ON CONSTRUCTION PERSONNEL**

Behavior of construction personnel on the site shall be expected to be exemplary. Foul language, rude or crude behavior, suggestive comments or actions, or other behavior considered unacceptable will not be tolerated. Shirts will be required to be worn at all times. Contractors will be responsible to counsel their personnel concerning the above restrictions and will be responsible to insure that these restrictions are enforced. Failure on the part of construction personnel to comply with the intent of these restrictions will be grounds for their permanent removal and banning from the Project site.

**ARTICLE 8 – E-PROCUREMENT**

ATTENTION: E-Procurement rules WILL apply for Registered E-Procurement Vendors only. Reference the General Contract Terms and Conditions, (Contractual and Consultant Services), paragraphs 19 and 20.

19. REGISTERED E-PROCUREMENT VENDORS:

ELECTRONIC PROCUREMENT (APPLIES TO ALL CONTRACTS THAT INCLUDE E-PROCUREMENT AND ARE IDENTIFIED AS SUCH IN THE BODY OF THE SOLICITATION DOCUMENT): Purchasing shall be conducted through the Statewide E-Procurement Service. The State's third party agent shall serve as the Supplier Manager for this E-Procurement Service.
THE SUCCESSFUL BIDDER (S) SHALL PAY A TRANSACTION FEE OF 1.75% (.0175) ON THE TOTAL DOLLAR AMOUNT (EXCLUDING SALES TAXES) OF EACH PURCHASE ORDER ISSUED THROUGH THE STATEWIDE E-PROCUREMENT SERVICE. This applies to all purchase orders, regardless of the quantity or dollar amount of the purchase order. The transaction fee shall not be stated or included as a separate item in the proposed contract or invoice. There are no additional fees or charges to the contractor for the services rendered by the Supplier Manager under this contract. Contractor will receive a credit for transaction fees they paid for the purchase of any item(s) if an item(s) is returned through no fault of the contractor. Transaction fees are non-refundable when an item is rejected and returned, or declined, due to the contractor's failure to perform or comply with specifications or requirements of the contract.
Contractor or its Authorized Reseller, as applicable, will be invoiced monthly for the State's transaction fee by the Supplier Manager. The transaction fee shall be based on purchase orders issued for the prior month. Unless Supplier Manager receives written notice from the Contractor identifying with specificity any errors in an invoice within thirty (30) days of the receipt of invoice, such invoice shall be deemed to be correct and Contractor shall have waived its right to later dispute the accuracy and completeness of the invoice. Payment of the transaction fee by the Contractor is due to the account designated by the State within thirty (30) days after receipt of the correct invoice for the transaction fee, which includes payment of all portions of an invoice not in dispute. Within thirty (30) days of the receipt of invoice, contractor may request in writing an extension of the invoice payment due date for that portion of the transaction fee invoice for which payment of the related goods by the governmental purchasing entity has not been received by the Contractor. If payment of the transaction fee is not received by the State within this payment period, it shall be considered a material breach of contract. The Supplier Manager shall provide, whenever reasonably requested by the contractor in writing (including

electronic documents), supporting documentation from the E-Procurement Service that accounts for the amount of the invoice.
The Supplier Manager will capture the order from the State approved user, including the shipping and payment information, and submit the order in accordance with the E-Procurement Service. Subsequently, the Supplier Manager will send those orders to the appropriate contractor on State Contract. The State or State approved user, not the Supplier Manager, shall be responsible for the solicitation, bids received, evaluation of bids received, award of contract, and the payment for goods delivered.
Contractor agrees at all times to maintain the confidentiality of its user name and password for the Statewide E-Procurement Services. If a contractor is a corporation, partnership or other legal entity, then the contractor may authorize its employees to use its password. Contractor shall be responsible for all activity and all charges by such employees. Contractor agrees not to permit a third party to use the Statewide E-Procurement Services through its account. If there is a breach of security through the contractor's account, contractor shall immediately change its password and notify the Supplier Manager of the security breach by e-mail. Contractor shall cooperate with the State and the Supplier Manager to mitigate and correct any security breach.

20. NON-REGISTERED E-PROCUREMENT VENDORS: E-Procurement Rules DO NOT apply.

**END OF SECTION 00 90 10**

SECTION 01 0200 – GENERAL SITEWORK REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 SITEWORK LAYOUT

A. Monuments and Benchmarks

1. Maintain all monuments, property corners, bench marks and other reference points.
2. If these are disturbed or destroyed during construction operations, have them replaced by a surveyor licensed in the State of North Carolina. This replacement shall be at no additional expense to the Contract.

B. Laying out the Work.

1. Locate all existing bench marks and other reference points.
2. Protect these points throughout construction.
3. Layout work utilizing these reference points.

C. Record Drawings

1. Maintain a record of the locations of all underground utilities and piping.
2. Maintain a record of any variations of the work.
3. Record Drawings shall be certified by a Land Surveyor registered in the State of North Carolina.
4. Submit these record drawings at Project Closeout.

1.3 EASEMENTS

A. Verify the acquisition of all off-site easements and Rights-of-Way prior to the start of off-site construction. This may be done by contacting the Architect.

B. Restore all off-site easements to the condition existing prior to the start of work.

1.4 MAINTENANCE OF TRAFFIC

A. Maintain vehicular and pedestrian traffic across the frontage of this project. Comply with all applicable safety requirements.

1.5 SUBMITTALS

A. For those submittals, close-out documents and O&M manuals requiring review by the architect's consultants, contractor shall ship such documents directly to the consultant, while sending a copy of the transmittal to the architect.

1.6 CORRELATION OF CONSTRUCTION DOCUMENTS

A. Review construction documents thoroughly prior to the start of construction.

B. Report any conflict or discrepancy discovered in the Construction Documents to the Architect prior to the start of construction.

C. Report any conflict or discrepancy discovered between the Construction Documents and state and local governmental regulations to the Architect prior to the start of construction.

1.7 PROJECT CONDITIONS

A. The conditions existing at the time of inspection for bidding purposes will be maintained by the Owner to the extent practical. However, minor variations may occur due to natural occurrences prior to the start of work.

B. The location of existing underground utilities indicated is approximate only. Field locate all existing underground utilities in the area of work, regardless of whether or not they are indicated. Call "NC one call" at 1800-632-4949 prior to the start of demolition work for assistance in the location of existing underground utilities.

C. Should charted, uncharted or incorrectly charted utilities be encountered during demolition, contact the Architect immediately for instructions. Cooperate with Owner and utility companies to keep services and facilities in operation.

1.8 SCHEDULING

A. Do not begin work on any off-site roadway improvements until the owner has acquired and recorded all easements and right-of-way required to complete the project.

PART 2 - PRODUCTS

Not Applicable

PART 3 – EXECUTION

3.1 PROJECT CLEAN UP

A. Clean site as construction progresses. Do not allow trash or other waste materials to accumulate.

B. Prior to requesting the punch-list inspection, clean the site to the following requirements:

1. Power wash all walks and pavements.
2. The remainder of the site shall be broom clean.
3. Remove all trash and debris.

3.2 EXISTING FACILITIES

A. Preserve existing signs, markers, guardrails and fences in their original condition unless written permission is obtained for their removal and replacement.

B. Replace damaged items at no additional cost to the Contract.

END OF SECTION 01 0200

**SECTION 01 10 00 - SUMMARY**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
1. Work covered by the Contract Documents.
2. Type of the Contract.
3. Work phases.
4. Work under other contracts.
5. Contractor's use of site and premises.
6. Coordination with Occupants.
7. Work restrictions.
8. Specification formats and conventions.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: **Northwoods Park Middle School Gymnasium and Renovation**
1. Project Location: **904 Sioux Drive, Jacksonville, NC 28540**.
B. Owner: **Onslow County Board of Education, 200 Broadhurst Road, Post Office Box 99, Jacksonville, NC 28540**
C. Architect: Smith Sinnett Architecture, 4600 Lake Boone Trail, Suite 205, Raleigh, North Carolina 27607.
D. This bid package consists of the construction of an 18,129 square foot gymnasium, 10,385 renovation of existing athletic space into classrooms, and parking expansion, in Jacksonville, NC for Onslow County Schools. The gymnasium will include locker areas, associative storage, offices, a classroom, and concession. Renovation will include a science classroom, four general education classrooms, an office, and two resource spaces. The project includes all other work as shown, indicated or reasonably implied on the drawings and/or specifications for a complete, first class job.

1.4 TYPE OF CONTRACT

A. Project will be constructed under a single prime contract. Bidders submitting single prime contract bids, and subsequently successful single prime Contractors, shall be aware that all work of the project is included in the Work of a single prime contractor, regardless of the divisions of work indicated on the Drawings and in the Project Manual. All references and indications in the Drawings and the Project Manual to separate Prime Contracts shall apply to the Single Prime Contract. Bid Alternates and Unit Prices shall apply to the Single Prime Contract. Allowances shall be included in the Single Prime Contract.

1.5 WORK UNDER OTHER CONTRACTS:

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

1.6 CONTRACTOR'S USE OF SITE AND PREMISES

A. Limits on Use of Site: Limit use of Project site to Work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated or otherwise approved by the Owner and Architect.

1. Driveways, Walkways, and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.

B. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

C. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.7 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy site and adjacent buildings during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

1.8 WORK RESTRICTIONS

A. Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7 a.m. to 7 p.m., Monday through Friday, unless otherwise indicated.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Construction Manager not less than two days in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.

D. Noise, Vibration, Dust, and Odors: Coordinate operations that may result in high levels of noise and vibration, dust, odors, or other disruption to Owner occupancy with Owner.

1. Notify Construction Manager not less than two days in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

E. Smoking and Controlled Substance Restrictions: Use of tobacco products and other controlled substances on Owner's property is not permitted.

F. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

G. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.

1. Maintain list of approved screened personnel with Owner's representative.

1.9 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's "Master Format" numbering system.

B. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.

C. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.

D. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

E. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

1. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

**END OF SECTION 01 10 00**

# SECTION 01 21 00 - ALLOWANCES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes administrative and procedural requirements 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 additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.
   2. The Contractor shall include in the Contract Sum all allowances states in the Contract Documents. The Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for the original allowance shall be included in the Contract Sum and not in the allowance, unless indicated otherwise herein. Coordinate allowance work with related work to ensure that each selection in completely integrated and interfaced with related work. Include all allowance amounts as a separate line item amount on each application for payment.

B. Types of allowances include the following:
   1. Unit-cost allowances.
   2. Quantity allowances.
   3. Contingency Allowances.

C. Related Sections include the following:
   1. Division 01 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders for allowances.
   2. Division 01 Section "Unit Prices" for procedures for using unit prices as bases to establish allowance value.
   3. Divisions 02 through 49 Sections for items of Work covered by allowances.
   4. Division 31 Section 'Earth Moving for Sites" and 'Earth Moving for Building" for procedures for measurements and payment for Unsuitable Soil Replacement.

### 1.3 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise the Architect of the date when final selection and purchase of each product or system described by an allowance must be completed 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. **Provide a minimum of three (3) proposals for each allowance** for use in making final selections, unless instructed otherwise by the Architect. Furnish proposals in time so as not to delay the project. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.4 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.
B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 ALLOWANCES

A. Refer to Schedule of Allowances for Amounts and Quantities
B. Quantity & Lump Sum Allowances
   1. Allowance shall include cost to Contractor of specific products and materials ordered by Owner under allowance and shall include taxes, freight, and delivery to Project site.
   2. Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner under allowance shall be included as part of the Contract Sum and not part of the allowance.
C. Unit-Cost Allowances
   1. Each change order amount for unit-cost type allowances shall be based solely on the difference between the actual unit purchase amount and the unit allowance, multiplied by the final measure or count of work-in-place, with reasonable allowances, where applicable, for cutting losses, tolerances, mixing wastes, normal product imperfections and similar margins.
   2. Include installation costs in the purchase amount only where indicated as a part of the allowance. When requested, prepare explanations and documentation to substantiate the margins as claimed. Prepare and submit substantiation of a change in the scope of work (if any) claimed in the change orders related to unit-cost type allowances. The Owner reserves the right to establish the actual quantity of work- in-place by an independent quantity survey, measure or count.
   3. Unit-Cost Allowances shall be based on the Unit Price value established.
D. Contingency Allowances
   1. 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.
   2. Contractor's 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, taxes, insurance, equipment rental, and similar costs.
   3. Allowances for overhead and profit shall be provided within the contract price and not included as part of any change order till the allowance amount has been spent.

1.7 CHANGE ORDER MARK-UP

A. Except as otherwise indicated, comply with provisions of General Conditions and other requirements stated in this section. For each allowance, Contractor's claims for increased costs (for either purchase order amount or Contractor's handling, labor, installation, overhead, and profit), because of a change in scope or nature of the allowance work as described in contract documents, must be submitted within 60 days of initial change order authorizing work to proceed on that allowance; otherwise, such claims will be rejected.

B. As a procedural restriction no mark-up (increase or decrease) shall be included in the change order amount for Contractor's increase or decrease in handling, labor, installation, overhead or profit unless purchase order amount varies by more than 15% from allowance amount.

C. Change orders prepared to return unused allowance amounts to the Owner shall be subject to the same requirements for the return of appropriate profit and overhead as other change orders in accordance with the Conditions of the Contract. Where the Contractor has been directed not to include his related costs (profit and overhead) in the Contract Sum for contingency allowances, the return of profit and overhead shall not be expected.

1.8 UNUSED MATERIALS

A. Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, prepare unused material for storage by Owner when it is not economically practical to return the material for credit. If directed by Architect, deliver unused material to Owner's storage space. Otherwise, disposal of unused material is Contractor's responsibility.

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 No. UP/A-1**: Unsuitable soils removal and disposal off-site.

1. Purpose: To adjust the contract sum in case a quantity different from that indicated in the allowance is required.
2. Unit of measurement: cubic yard in place prior before removal.
3. Include the following in the unit price:
   a. Excavation, loading, transport and legal disposal of all materials.
   b. All disposal fees.
   c. Overhead and profit.
4. Include all other related costs in the contract sum.
5. Method of measurement: Quantities will be verified by a soils and materials engineer employed by the Owner.
6. Quantity Allowance: Coordinate unit price with allowance adjustment requirements of Division 01 Section “Allowances.”
7. **Allowance Quantity: 1,000-cy.**

B. **Allowance No. UP/A-2**: Replacement of removed rock or unsuitable soils removal with off-site suitable soil in-place.
   1. Purpose: To adjust the contract sum in case a quantity different from that indicated in the allowance is required.
   2. Unit of measurement: cubic yard of void to be filled.
   3. Include the following in the unit price:
      a. Suitable soil materials from Contractor's off-site source.
      b. Excavation, loading, transport, placement, moisture control and compaction of suitable soil into void remaining from removed rock or unsuitable soil.
      c. Overhead and profit.
   4. Include all other related costs in the contract sum. Unit price shall not include the excavation of unsuitable soil or rock.
   5. Method of measurement: Quantities will be verified by a soils and materials engineer employed by the Owner.
   6. Quantity Allowance: Coordinate unit price with allowance adjustment requirements of Division 01 Section "Allowances."
   7. **Allowance Quantity: 500-cy.**

C. **Allowance No. UP/A-3**: Replacement of authorized excavation of unsuitable soils or rock with Aggregate Base Course (ABC) stone material.
   1. Purpose: To adjust the contract sum in case a quantity different from that indicated in the allowance is required.
   2. Unit of measurement: cubic yard of void to be filled, compacted in place.
   3. Include the following in the unit price:
      a. Certified ABC materials from Contractor's off-site source.
      b. Excavation, loading, transport, placement, moisture control and compaction of materials into void remaining from removed rock or unsuitable soils.
      c. Overhead and profit.
   4. Include all other related costs in the contract sum. Unit price shall not include the excavation of unsuitable soil or rock.
   5. Include costs related to removal of rock or unsuitable soil in other Unit Prices.
   6. Method of measurement: Quantities will be verified by a soils and materials engineer employed by the Owner.
   7. Quantity Allowance: Coordinate unit price with allowance adjustment requirements of Division 01 Section "Allowances."
   8. **Allowance Quantity: 250-cy.**

D. **Allowance No. UP/A-4**: Replacement of authorized excavation of unsuitable soils or rock with #57 Washed Stone material.
   1. Purpose: To adjust the contract sum in case a quantity different from that indicated in the allowance is required.
   2. Unit of measurement: cubic yard of void to be filled, compacted in place.
   3. Include the following in the unit price:
      a. Certified #57 Washed Stone materials from Contractor's off-site source.
      b. Excavation, loading, transport, placement, moisture control and compaction of materials into void remaining from removed rock or unsuitable soil.
      c. Overhead and profit.
   4. Include all other related costs in the contract sum. Unit price shall not include the excavation of unsuitable soil or rock.
   5. Include costs related to removal of rock or unsuitable soil in other Unit Prices.
   6. Method of measurement: Quantities will be verified by a soils and materials engineer employed by the Owner based on volume of void to be filled.
   7. Quantity Allowance: Coordinate unit price with allowance adjustment requirements of Division 01 Section "Allowances."
   8. **Allowance Quantity: 250-cy.**

E. **Allowance No. UP/A-5**: Woven Geo-Textile Fabric in place.
1. Purpose: To adjust the contract sum in case a quantity different from that indicated in the allowance is required.
2. Unit of measurement: square yard of ground surface covered. Overlap, waste or excess shall not be included in payment measurements.
3. Include the following in the unit price:
   a. Materials and transport to site.
   b. Unloading, handling, and placement.
   c. Overhead and profit.
4. Include all other related costs in the contract sum.
5. Method of measurement: Quantities will be verified by a soils and materials engineer employed by the Owner.
6. Quantity Allowance: Coordinate unit price with allowance adjustment requirements of Division 01 Section "Allowances."
7. **Allowance Quantity: 260-sy.**

F. **Allowance No. UP/A-6**: Biaxial Geo-Grid in place.
1. Purpose: To adjust the contract sum in case a quantity different from that indicated in the allowance is required.
2. Unit of measurement: square yard of ground surface covered. Overlap, waste or excess shall not be included in payment measurements.
3. Include the following in the unit price:
   a. Materials and transport to site.
   b. Unloading, handling, and placement.
   c. Overhead and profit.
4. Include all other related costs in the contract sum.
5. Method of measurement: Quantities will be verified by a soils and materials engineer employed by the Owner.
6. Quantity Allowance: Coordinate unit price with allowance adjustment requirements of Division 01 Section "Allowances."
7. **Allowance Quantity: 260-sy.**

G. **Allowance No. UP/A-7**: Subsurface Drain.
1. Purpose: To adjust the contract sum in case a quantity different from that indicated in the allowance is required.
2. Unit of measurement: linear foot of 24" wide x 36" deep backhoe excavated trenches filled with NCDOT No. 57 Stone encapsulated in non-woven geotextile fabric, Mirafi 140N, or approved equal. 4" perforated HDPE pipe installed near bottom of drain. Drain by gravity at a minimum slope of 0.25 percent.
3. Include the following in the unit price:
   a. Materials and transport to site.
   b. Unloading, handling, placement, and compaction.
   c. Overhead and profit.
4. Include all other related costs in the contract sum.
5. Method of measurement: Quantities will be verified by a soils and materials engineer employed by the Owner.
6. Quantity Allowance: Coordinate unit price with allowance adjustment requirements of Division 01 Section "Allowances."
7. **Allowance Quantity: 500-lf.**

H. **Allowance No. UP/A-8:** Topical Moisture Mitigation System
1. Include sufficient moisture vapor mitigation system to be applied to the existing building's concrete slab as an Allowance in the Base Bid where moisture emissions exceed 5 lbs / 1000sf in 24 hours. Allowance shall be based on the unit price quoted in the Proposal.
2. **Quantity: 8,000 sf.**

I. **Allowance No. A-9:** Access Control – Security Cameras, Intrusion Detection, & Card Readers
1. Allow a lump sum for purchase and installation of Security Cameras, Intrusion Detection, and a complete Access Control System, as required by the Owner for connections between existing system and new addition and renovations, and as defined by and specified in contract documents.
2. **Lump Sum: $90,000.**

J. **Allowance No. A-10:** Structured Cabling
1. Allow a lump sum for purchase and installation of structured cabling, as defined by and specified in contract documents.
2. **Lump Sum: $60,000.**

K. **Allowance No. A-11:** Technology, Furnishings, & Gymnasium Sound System
1. Allow a lump sum for purchase and installation of network electronics and furnishings, including but not limited to switches, wireless access points, (6) mobile display carts with monitors, and complete gymnasium sound system as defined by and specified in contract documents.
2. **Lump Sum: $110,000.00.**

L. **Allowance No. A-12:** Appliances
1. Allow a lump sum for purchase and installation of appliances, as defined by and specified in contract documents.
2. **Lump Sum: $15,000.00.**

M. **Allowance No. A-13:** Signage
1. Allow a lump sum for purchase and/or construction of wayfinding, site signage, interior graphics, interior panel signage, fire extinguisher signage, and dimensional lettering, as defined by and specified in "Signage" section of Division 10. Signage material and applicable sales taxes will be paid for as part of this allowance. Note: Labor for Sign Installation shall be included in the Base Bid.
2. **Lump Sum: $10,000.00.**

N. **Allowance No. A-14:** Bi-directional Amplification (BDA)
1. Allow a lump sum for purchase and installation of a BDA system. Determination of the need of a BDA system will be determined via field testing which will occur near the end of construction.
2. **Lump Sum: $75,000.**

O. **Allowance No. A-15**: Contingency
1. Contingency allowance shall be provided as follows and the price shall be adjusted based on the actual cost of subcontracts, materials, and labor, excluding overhead and profit. Allowances for overhead and profit shall be provided within the contract price. If there is unused allowance at the conclusion of the project, the allowance plus 5% profit will be deducted from the contract.
2. **Contingency: $385,000.00**

**END OF SECTION 01 21 00**

# SECTION 01 22 00 - UNIT PRICES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes administrative and procedural requirements for unit prices and effects all prime Contracts.

B. Related Sections include the following:
1. Division 01 Section below contains requirements that relate directly to unit prices.
2. Division 01 Section "Allowances" for procedures to adjust quantity allowances and quantities of Unit Prices to be included in the Base Bid.
3. Division 01 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
4. Division 01 Section "Quality Requirements" for general testing and inspecting requirements.
5. Division 31 Section “Earth Moving” for procedures for measurement and payment for Unsuitable Soil Replacement.

### 1.3 DEFINITIONS

A. Unit price is an amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased. Unit Prices shall be used to calculate Allowance values.

### 1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: Refer to 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.

D. List of Unit Prices: A list of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 LIST OF UNIT PRICES

A. **Allowance No. UP/A-1**: Unsuitable soils removal and disposal off-site.
   1. Purpose: To adjust the contract sum in case a quantity different from that indicated in the allowance is required.
   2. Unit of measurement: cubic yard in place prior to excavation.

B. **Allowance No. UP/A-2**: Replacement of authorized excavation of unsuitable soils or rock with off-site imported fill material.
   1. Purpose: To adjust the contract sum in case a quantity different from that indicated in the allowance is required.
   2. Unit of measurement: cubic yard, compacted in place.

C. **Allowance No. UP/A-3**: Replacement of authorized excavation of unsuitable soils or rock with Aggregate Base Course (ABC) stone material.
   1. Purpose: To adjust the contract sum in case a quantity different from that indicated in the allowance is required.
   2. Unit of measurement: cubic yard, compacted in place.

D. **Allowance No. UP/A-4**: Replacement of authorized excavation of unsuitable soils or rock with #57 Washed Stone material.
   1. Purpose: To adjust the contract sum in case a quantity different from that indicated in the allowance is required.
   2. Unit of measurement: cubic yard, compacted in place.

E. **Allowance No. UP/A-5**: Woven Geo-Textile Fabric in place.
   1. Purpose: To adjust the contract sum in case a quantity different from that indicated in the allowance is required.
   2. Unit of measurement: square yard of ground surface covered. Overlap, waste or excess shall not be included in payment measurements.

F. **Allowance No. UP/A-6**: Biaxial Geo-Grid in place.
   1. Purpose: To adjust the contract sum in case a quantity different from that indicated in the allowance is required.
   2. Unit of measurement: square yard of ground surface covered. Overlap, waste or excess shall not be included in payment measurements.

G. **Allowance No. UP/A-7**: Subsurface Drain.
   1. Purpose: To adjust the contract sum in case a quantity different from that indicated in the allowance is required.
   2. Unit of measurement: linear foot of 24” wide x 36” deep backhoe excavated trenches filled with NCDOT No. 57 Stone encapsulated in non-woven geotextile fabric, Mirafi 140N, or approved equal. 4” perforated HDPE pipe installed near bottom of drain. Drain by gravity at a minimum slope of 0.25 percent.

H. **Allowance No. UP/A-8:** Topical Moisture Mitigation System.
   1. Provide unit price for a moisture vapor mitigation system to be applied to the existing building’s concrete slab where moisture emissions exceed 5 lbs/ 1000sf in 24 hours.
   2. Unit of measurement: square foot of mitigation installed on slab and measured in place.

**END OF SECTION 01 22 00**

# SECTION 01 23 00 - ALTERNATES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes administrative and procedural requirements for alternates.

### 1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to 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. The cost or credit for each alternate is the net addition to the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

### 1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
B. 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.
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 modifications 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

A. **Alternate No. 1; Paint Existing Exposed Steel:** State the amount to be added to the Base Bid for providing all labor and materials to prepare and paint all exterior exposed steel as shown and noted in the Contract Drawings per the plans and specifications.

B. **Alternate No. 2; Owner Preferred Door Hardware Manufacturers:** State the amount to be added to the Base Bid for providing all labor and materials indicated and required to accomplish Work involved in providing the Owner Preferred Manufacturers Listed Below:
1. Door Locks: Manufacturer
   a. Schlage
2. Exit Devices: Manufacturer
   a. Von Duprin
3. Closers: Manufacturer
   a. LCN

C. **Alternate No. 3; Owner Preferred Plumbing Manufacturer:** State the amount to be added to the Base Bid for providing all labor and materials indicated and required to accomplish Work involved in providing the Owner Preferred Manufacturers Listed Below:
1. Water Cooler with Bottle Filler: Manufacturer
   a. Elkay

D. **Alternate No. 4; Owner Preferred Mechanical Manufacturers:** State the amount to be added to the Base Bid for providing all labor and materials indicated and required to accomplish Work involved in providing the Owner Preferred Manufacturers Listed Below:
1. HVAC Equipment for Chillers and Air Handlers: Manufacturer
   a. Trane – For the Existing Building Renovation portion of the project
   b. Aaon – For the new Gymnasium Building
2. HVAC Controls: Manufacturer
   a. Schneider **OR** Brady

E. **Alternate No. 5; Owner Preferred Electrical Manufacturers:** State the amount to be added to the Base Bid for providing all labor and materials indicated and required to accomplish Work involved in providing the Owner Preferred Manufacturers Listed Below:
1. Fire Alarm System: Manufacturer
   a. Notifier
2. Electrical Equipment: Manufacturer
   a. Square D
3. Intercom Equipment: Manufacturer
   a. Nyquist Paging

F. **Alternate No. 6; Owner Preferred Termite Treatment Manufacturer:** State the amount to be added to the Base Bid for providing all labor and materials indicated and required to accomplish Work involved in providing the Owner Preferred Manufacturers Listed Below:
1. Termiticide
   a. Termidor SC

G. **Alternate No. 7; Owner Preferred Translucent Wall Manufacturer:** State the amount to be added to the Base Bid for providing all labor and materials indicated and required to accomplish Work involved in providing the Owner Preferred Manufacturers Listed Below:
1. Translucent Wall Assemblies
   a. Kalwall

H. Note that for any and all Preferred Alternates, equal products are **ONLY** allowed in the Base Bid.

**END OF SECTION 01 23 00**

# SECTION 01 25 00 - SUBSTITUTION PROCEDURES

## 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. Administrative and procedural requirements for handling requests for substitutions made after award of the Contract.

B. Related Sections:
1. Division 01 Section "References" specifies the applicability of industry standards to products specified.
2. Division 01 Section "Submittals" specifies requirements for submitting the Contractor's Construction Schedule and the Submittal Schedule.

### 1.3 DEFINITIONS

A. Definitions in this Article do not change or modify the meaning of other terms used in the Contract Documents.

B. Substitutions: Changes in products, materials, equipment, and methods of construction required by the Contract Documents proposed by the Contractor after award of the Contract are considered to be requests for substitutions. The following are not considered to be requests for substitutions:
1. Substitutions requested during the bidding period, and accepted by Addendum prior to award of the Contract, are included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.
2. Revisions to the Contract Documents requested by the Owner or Architect.
3. Specified options of products and construction methods included in the Contract Documents.
4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

### 1.4 SUBMITTALS

A. Within 30 consecutive calendar days after the notice to proceed, each prime contractor shall submit a schedule for anticipated submission of all shop drawings, product data, samples, and similar submittals to the Project Expediter and the Designer. This schedule shall indicate the items, relevant specification sections, other related submittal, data, and the date when these items will be furnished to the designer.

B. Each contractor shall obtain written approval from the designer for the use of products, materials**,** equipment**,** assemblies or installation methods claimed as equal to those specified. Such approvals must be obtained as soon after contract awards as possible and before any materials are ordered. Applications for approvals shall be made by the contractor and not by subcontractors or material suppliers within thirty 30 days following award of contract. When the submittal schedule provided is approved, no further

substitutions will be permitted except in unusual or extenuating circumstances. If no list is submitted, the contractor shall supply materials specified.

C. Substitution Request Submittal: The Architect will consider requests for substitution if received within 10 consecutive calendar days prior to bid. Requests received more than 10 consecutive calendar days prior to bid will be rejected at the discretion of the Architect.
   1. Submit 3 copies of each request for substitution for consideration. Submit requests in the form and according to procedures required for change-order proposals.
   2. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers.
   3. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
      a. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate contractors that will be necessary to accommodate the proposed substitution.
      b. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements, such as performance, weight, size, durability, and visual effect.
      c. Product Data, including Drawings and descriptions of products and fabrication and installation procedures. Samples, where applicable or requested.
      d. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
      e. Cost information, including a proposal of the net change, if any in the Contract Sum.
      f. The Contractor's certification that the proposed substitution conforms to requirements in the Contract Documents in every respect and is appropriate for the applications indicated.
      g. The Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

   4. Architect's Action: If necessary, the Architect will request additional information or documentation for evaluation within one week of receipt of a request for substitution. The Architect will notify the Contractor of acceptance or rejection of the substitution within 2 weeks of receipt of the request, or one week of receipt of additional information or documentation, whichever is later. Acceptance will be in the form of a change order.
      a. Use the product specified if the Architect cannot make a decision on the use of a proposed substitute within the time allocated.

## PART 2 - PRODUCTS

### 2.1 SUBSTITUTIONS

A. Conditions: The Architect will receive and consider the Contractor's request for substitution when one or more of the following conditions are satisfied, as determined by the Architect. If the following conditions are not satisfied, the Architect will return the requests without action except to record noncompliance with these requirements.
   1. Extensive revisions to the Contract Documents are not required.
   2. Proposed changes are in keeping with the general intent of the Contract Documents.
   3. The request is timely, fully documented, and properly submitted.
   4. The specified product or method of construction cannot be provided within the Contract Time.
   5. The Architect will not consider the request if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
   6. The request is directly related to an "or-equal" clause or similar language in the Contract Documents.

7. The requested substitution offers the Owner a substantial advantage, in cost, time, energy conservation, or other considerations, after deducting additional responsibilities the Owner must assume. The Owner's additional responsibilities may include compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner, and similar considerations.
8. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
9. The specified product or method of construction cannot be provided in a manner that is compatible with other materials and where the Contractor certifies that the substitution will overcome the incompatibility.
10. The specified product or method of construction cannot be coordinated with other materials and where the Contractor certifies that the proposed substitution can be coordinated.
11. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provides the required warranty.
12. Where a proposed substitution involves more than one contractor, each contractor shall cooperate with the other contractors involved to coordinate the Work, provide uniformity and consistency, and assure compatibility of products.

B. The Contractor's submittal and the Architect's acceptance of Shop Drawings, Product Data, or Samples for construction activities not complying with the Contract Documents do not constitute an acceptable or valid request for substitution, nor do they constitute approval.

PART 3 - EXECUTION (Not Used)

**END OF SECTION 01 25 00**

# SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections include the following:
1. Division 01 Section "Allowances" for procedural requirements for handling and processing allowances.
2. Division 01 Section "Unit Prices" for administrative requirements for using unit prices.
3. Division 01 Section “Submittal Procedures” for requirements for the Contractor’s Construction Schedule.
4. Division 01 Section “Payment Procedures” for administrative procedures governing Applications for Payment.
5. Division 01 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

### 1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on appropriate form.

### 1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: **Architect** will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

B. Proposal Requests issued by **Architect** are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
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.
1. 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.
2. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
3. Include costs of labor and supervision directly attributable to the change.
4. 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.

C. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to **Architect**.
   1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
   2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   4. Include costs of labor and supervision directly attributable to the change.
   5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
   6. Comply with requirements in Division 01 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

D. Proposal Request Form: Use AIA Document G709 for Proposal Requests.

## 1.5 ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, base each Change Order proposal on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
   1. Include installation costs in purchase amount only where indicated as part of the allowance.
   2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
   3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
   4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the Purchase Order amount or Contractor's handling, labor, installation, overhead, and profit. Submit claims within **(7) Seven** days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. Owner will reject claims submitted later than **(7) seven** days after such authorization.
   1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
   2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

## 1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, **Architect** will issue an electronic Change Order for signing and approval of Owner, and Contractor.

## 1.7 CONSTRUCTION CHANGE DIRECTIVE

A. **Construction** Change Directive: **Architect** may issue a **Construction** Change Directive on **appropriate electronic form**. Directive shall be followed up by a Change Order.

B. **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.

C. 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 01 26 00**

# SECTION 01 29 00 - PAYMENT PROCEDURES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Sections include the following:
1. Division 01 Section "Allowances" for procedural requirements governing handling and processing of allowances.
2. Division 01 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
3. Division 01 Section "Unit Prices" for administrative requirements governing use of unit prices.

### 1.3 DEFINITIONS

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

### 1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
   a. Application for Payment forms with Continuation Sheets.
   b. Submittals Schedule.
   c. Contractor's Construction Schedule.
   d. List of Subcontractors.
   e. Schedule of Allowances
   f. Schedule of Alternates.
   g. List of Products.
   h. List of Principal Suppliers and Fabricators.
2. Submit the Schedule of Values to Architect at earliest possible date but no later than (7) seven days before the date scheduled for submittal of initial Applications for Payment.
3. Subschedules: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
1. Identification: Include the following Project identification on the Schedule of Values:
   a. Project name and location.

b. Name of Architect.
c. Architect's project number.
d. Contractor's name and address.
e. Date of submittal.

2. Submit draft of AIA Document G703 Continuation Sheets. 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. Name of subcontractor.
   d. Name of manufacturer or fabricator.
   e. Name of supplier.
   f. Change Orders (numbers) that affect value.
   g. Dollar value.
      1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate. **Include separate line items under required principal subcontracts for operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training in the amount of 5 percent of the Contract Sum.**
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. 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. DO NOT bill for off-site stored materials.
6. 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.
7. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
8. 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.
9. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.
10. Shop Drawings and Mobilization- Applications for payment shall not include preparation of shop drawings or mobilization. These items shall be included as part of work-in-place.
11. General Conditions: Applications for Payment for General Conditions shall be paid for in proportion to the amount of work completed.
12. Bonds and Insurance: Applications for Bonds and Insurance shall be accompanied with invoices from the Bond and Insurance provider.

## 1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
   1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Forms: Use **AIA Document G702 and Contractor's construction schedule indicating Item No., % complete, amount earned, amount earned current pay period, and amount remaining** 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** 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 of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Transmittal: Submit **5** five 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.

F. Waivers of Mechanic's Lien: With each Application for Payment, submit a notarized waiver of mechanic's lien from the Prime Contractor. With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application. With each Application for Payment, submit waivers of mechanic's lien from every entity who is 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 final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

G. Bill of Material: With each Application for Payment, submit a bill of materials for each stored material listed for payment on the pay application. The bill of material shall state the quantity of material, stored on site, that is being billed for on the current Application for Payment. The bill of material shall correspond to the actually verified amount stored on site.

H. NC Sales Tax Form: With each Application for Payment, submit a NC Sales Tax form. Refer to form at end of this section.

I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
2. Schedule of Values.
3. Contractor's Construction Schedule (preliminary if not final).
4. Products list.
5. Schedule of unit prices.
6. Submittals Schedule (preliminary if not final).
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. Initial progress report.
12. Report of preconstruction conference.
13. Certificates of insurance and insurance policies.
14. Performance and payment bonds.
15. Data needed to acquire Owner's insurance.
16. Initial settlement survey and damage report if required.

J. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
3. Occupancy Permits and similar approvals.
4. Warranties (guarantees) and maintenance agreements.
5. Test/adjust/balance records.
6. Maintenance instructions.
7. Startup performance reports.
8. Changeover information related to Owner’s occupancy, use, operation, and maintenance.
9. Final Cleaning.
10. Application for reduction of retainage and consent of surety.
11. List of discrepancies (punchlist items), recognized as Owner approved exceptions that shall be completed within 30 days.
12. Advice on shifting insurance coverages.

K. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. 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.
10. Transmittal of required project construction records to the Owner.
11. Certified property survey
12. Removal of temporary facilities and services.
13. Removal of surplus materials, rubbish, and similar elements.
14. Change or door locks to Owner’s access.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

**END OF SECTION 01 29 00**

# SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. General coordination procedures.
   2. Coordination Drawings.
   3. Digital project management procedures.
   4. Submittals.
   5. Administrative and supervisory personnel.
   6. Project meetings.
   7. Requests for Interpretation (RFIs).

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.

C. Related Sections include the following:
   1. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.

### 1.3 DEFINITIONS

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

### 1.4 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, telephone number, and email address of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.

### 1.5 GENERAL COORDINATION PROCEDURES

A. The General Contractor shall coordinate the construction activities of other contractors, the Owner, and other entities involved to ensure efficient and orderly installation of each part of the work.

B. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction 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 to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities 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.

D. 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.

E. Conservation: The General Contractor shall coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

## 1.6 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, 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 the relationship of various systems and components.
b. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
e. Indicate required installation sequences.
f. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

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 subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components 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 (31.5 mm) 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, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If the 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 suitable modifications and resubmit.

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
2. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.
3. BIM File Incorporation: Develop and incorporate coordination drawing files into Building Information Model established for Project.
    a. Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
4. 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.

## 1.7 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Use of Architect's Digital Data Files: Digital data files of Architect's BIM model will be provided by Architect for Contractor's use during construction.

1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project record Drawings.
2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
3. Contractor shall execute a data licensing agreement in the form of AIA Document C106 Digital Data Licensing Agreement.
    a. Subcontractors, and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of AIA Document C106.

B. Web-Based Project Management Software Package: Use Construction Manager's web-based Project management software package for purposes of hosting and managing Project communication and documentation until Final Completion.
1. Web-based Project management software includes, at a minimum, the following features:
    a. Compilation of Project data, including Contractor, subcontractors, Architect, architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
    b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
    c. Document workflow planning, allowing customization of workflow between project entities.
    d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
    e. Track status of each Project communication in real time, and log time and date when responses are provided.
    f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
    g. Processing and tracking of payment applications.
    h. Processing and tracking of contract modifications.
    i. Creating and distributing meeting minutes.
    j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
    k. Management of construction progress photographs.
    l. Mobile device compatibility, including smartphones and tablets.
2. Provide web-based Project management software user licenses for use of Owner, Owner's Commissioning Authority, Construction Manager, Architect, and Architect's consultants.
    a. Architect to have a minimum of 2 designated licenses for project management software
    b. Owner to have a minimum of 5 licenses for project management software
    c. Project management software licenses to expire 1 year after project completion.
3. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.

C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

## 1.8 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
   a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
   b. Indicate required installation sequences.
   c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
2. Sheet Size: At least 8-1/2 by 11 inches but no larger than 30 by 42 inches.
3. Number of Copies: Submit two opaque copies of each submittal. Architect will return **one copy**.
   a. Submit five copies where Coordination Drawings are required for operation and maintenance manuals. Architect will retain two copies; remainder will be returned. Mark up and retain one returned copy as a Project Record Drawing.
4. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.

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 and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

## 1.9 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.
1. Include special personnel required for coordination of operations with other contractors.

B. Project Manager: General Contractor shall be required to provide and identify a qualified Project Manager who is responsible for overseeing all administrative activities for their Work.
1. The Contractor shall be required to demonstrate his capability to provide a qualified Project Manager for the project who is acceptable to the Owner and Architect. The Project Manager shall have at least five years successful experience on projects of similar size, scope and nature. Contractor shall be required to substantiate these qualifications with a written submittal within seven calendar days after opening of the Bids.
2. The Contractor is charged with providing a qualified and experienced Project Manager for this project to the satisfaction of the Owner and Architect, and the Owner reserves the right to disapprove a proposed Project Manager who does not appear to be fully qualified and experienced to accomplish the work of the Project.
3. This Project Manager shall have the necessary authority to speak on behalf of the Contractor and commit the Contractor’s resources.
4. Duties and responsibilities anticipated to be the responsibility of the Project Manager include, but are not limited to, the following:
   a. Preparation, submittal and coordination of required submittals.
   b. Scheduling and sequencing the Work.
   c. Preparation of coordination drawings.
   d. Coordination of materials and equipment purchasing, scheduling and delivery.
   e. Coordination of Subcontractor/Installer and labor force scheduling.
   f. Other duties and responsibilities as necessary and customary to back up and assist the Superintendent.
5. Project Manager shall have email access for the entire length of the project for communication with the design team, emailing of submittals, reports, field reports, proposal requests, RFIs, and change orders.

C. Superintendent: The Contractor shall be required to demonstrate his capability to provide a qualified project superintendent for the project who is acceptable to the Owner and Architect. The project superintendent shall have at least five years of successful experience on projects of similar size, scope and nature. Contractor shall be required to substantiate these qualifications with a written submittal within seven calendar days after opening of the Bids. The Contractor is charged with providing a qualified and experienced superintendent for this project to the satisfaction of the Owner and Architect. The Owner reserves the right to disapprove a proposed superintendent who does not appear to be fully qualified and experienced to accomplish the work of this project.
   1. Superintendent shall be onsite, without exception, anytime work is being performed.
      a. If the Superintendent needs to the leave the site for an extended amount of time, an acceptable replacement Superintendent shall be named and shall be onsite while work is taking place.

## 1.10 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
   1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
   2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
   3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Architect to schedule 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. The conference will be held at Project site or another convenient location. Architect to conduct the meeting to review responsibilities and personnel assignments.
   1. Attendees: Authorized representatives of Owner, Architect, and their consultants; and the Contractor project manager and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   2. Agenda: Discuss items of significance that could affect progress, including the following:
      a. Tentative construction schedule.
      b. Phasing.
      c. Critical work sequencing and long-lead items.
      d. Designation of key personnel and their duties.
      e. Procedures for processing field decisions and Change Orders.
      f. Procedures for RFIs.
      g. Procedures for testing and inspecting.
      h. Procedures for processing Applications for Payment.
      i. Distribution of the Contract Documents.
      j. Submittal procedures.
      k. Preparation of Record Documents.
      l. Use of the premises (and existing building if required).
      m. Work restrictions.
      n. Owner's occupancy requirements.
      o. Responsibility for temporary facilities and controls.
      p. Construction waste management and recycling.
      q. Parking availability.
      r. Office, work, and storage areas.
      s. Equipment deliveries and priorities.
      t. First aid.
      u. Security.
      v. Progress cleaning.
      w. Working hours.
   3. Minutes: Architect will record, prepare and distribute meeting minutes.

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

D. Monthly Meetings: Architect to establish and conduct monthly meetings minimum 1 per other. Additional monthly meetings may be added if requested by any party.
   1. Attendees: 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. In addition, representatives of Owner, Architect, Engineer will be present. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   2. Monthly Meetings shall be in person and Virtually using Microsoft Teams. Contractor shall provide all equipment necessary to host meetings Virtually.
   3. Agenda: Review and correct or approve minutes of previous monthly meetings. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
      a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to 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.

1) Review schedule for next period.
2) Provide update schedule at each meeting.

b. Review present and future needs of each entity present, including the following:
1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Work hours.
10) Hazards and risks.
11) Progress cleaning.
12) Quality and work standards.
13) Status of correction of deficient items.
14) Field observations.
15) RFIs.
16) Status of proposal requests.
17) Pending changes.
18) Status of Change Orders.
19) Pending claims and disputes.
20) Documentation of information for payment requests.

c. Review Coordination Drawings
d. Additional Coordination Meetings and Discussions.

4. Minutes: Architect will record, prepare and distribute to all relevant parties the monthly minutes.
5. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
a. Schedule Updating: Revise Contractor's Construction Schedule after each monthly meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

E. Progress Meetings: Conduct progress meetings at weekly intervals. Coordinate dates of meetings with preparation of payment requests.
1. Attendees: 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. In addition, representatives of Owner and Architect may be present All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to 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.
1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:
1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.

8) Temporary facilities and controls.
9) Work hours.
10) Hazards and risks.
11) Progress cleaning.
12) Quality and work standards.
13) Status of correction of deficient items.
14) Field observations.
15) RFIs.
16) Status of proposal requests.
17) Pending changes.
18) Status of Change Orders.
19) Pending claims and disputes.
20) Documentation of information for payment requests.

3. Minutes: Contractor will record and distribute to all relevant subcontractors the weekly minutes.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
   a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

F. Coordination Meetings: Contractor shall conduct project coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and pre-installation conferences.
   1. Attendees: 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. In addition, representatives of Owner and Architect may be present All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
      a. Combined 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.
      d. Reporting: Contractor shall Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

G. Site Coordination Meeting: Coordination meeting shall be held for the Contractor of the Regional Readiness Center and the Contractor of the Field Maintenance Shop.
   1. Meeting Shall be Monthly.
   2. Topics to discuss include, but not limited to, site access, major delivery, installation of site utilities, construction of roadways, asphalt paving, concrete paving, and fence installation.
   3. Both Contractors shall provide a construction schedule and be prepared to discuss activities and scheduling that have the potential to affect each other's critical path.

## 1.11 REQUESTS FOR INTERPRETATION (RFIs)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
   1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned 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 interpretation and the following:
   1. Project name.
   2. Date.
   3. Name of Contractor.
   4. Name of Architect.
   5. RFI number, numbered sequentially.
   6. Specification Section number and title and related paragraphs, as appropriate.
   7. Drawing number and detail references, as appropriate.
   8. Field dimensions and conditions, as appropriate.
   9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
   10. Contractor's signature.
   11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
      a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.

C. Software-Generated RFIs: Software-generated form with substantially the same content as indicated above.
   1. Identify each page of attachments with the RFI number and sequential page number.
   2. Attachments shall be electronic files in PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow ten working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
   1. The following RFIs will be returned without action:
      a. Requests for approval of submittals or substitutions.
      b. Requests for coordination information already indicated in the Contract Documents.
      c. Requests for adjustments in the Contract Time or the Contract Sum.
      d. Requests for interpretation of Architect's actions on submittals.
      e. Incomplete RFIs or RFIs with numerous errors.
   2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
   3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
      a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within (10) days of receipt of the RFI response.

E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:
   1. Project name.
   2. Name and address of Contractor.
   3. Name and address of Architect.
   4. RFI number including RFIs that were dropped and not submitted.
   5. RFI description.
   6. Date the RFI was submitted.
   7. Date Architect's response was received.
   8. Identification of related Minor Change in the Work, Field Order, Construction Change Directive, and Proposal Request, as appropriate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL COORDINATION PROVISIONS

A. Inspection of Conditions: The Contractor shall require the Installer of each major component to inspect both the substrate and conditions under which work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.

3.2 CLEANING AND PROTECTION

A. Clean and protect construction in progress and adjoining materials in place during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at Substantial Completion.

B. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to assure operability without damaging effects.

C. Limiting Exposures: Each contractor shall supervise its 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. Where applicable, such exposures include, but are not limited to, the following:
   1. Excessive static or dynamic loading, internal or external pressures, high or low temperatures.
   2. Thermal shock.
   3. Excessively high or low humidity.
   4. Air contamination or pollution.
   5. Water or ice.
   6. Solvents or Chemicals.
   7. Light.
   8. Radiation.
   9. Puncture
   10. Abrasion.
   11. Heavy traffic.
   12. Soiling, staining, and corrosion.

13. Bacteria.
14. Rodent and insect infestation.
15. Combustion.
16. Electrical current.
17. High-speed operation.
18. Improper lubrication.
19. Unusual wear or other misuse.
20. Contact between incompatible materials.
21. Destructive testing.
22. Misalignment.
23. Excessive weathering.
24. Unprotected storage.
25. Improper shipping or handling.
26. Theft or Vandalism.

**END OF SECTION 01 31 00**

# SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Preliminary Construction Schedule.
   2. Contractor's Construction Schedule.
   3. Submittals Schedule.
   4. Daily construction reports.
   5. Material location reports.
   6. Field condition reports.
   7. Special reports.

B. Related Sections include the following:
   1. Division 01 Section "Payment Procedures" for submitting the Schedule of Values.
   2. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
   3. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
   4. Division 01 Section "Quality Requirements" for submitting a schedule of tests and inspections.

### 1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
   1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
   2. Predecessor Activity: An activity that precedes another activity in the network.
   3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the Schedule of Values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by Architect.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.
   1. Float time **belongs to Owner**.
   2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.

3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

H. Major Area: A story of construction, a separate building, or a similar significant construction element.

I. Milestone: A key or critical point in time for reference or measurement.

J. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

K. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

## 1.4 SUBMITTALS

A. Qualification Data: For scheduling consultant.

B. Submittals Schedule: Submit **three** copies of schedule. Arrange the following information in a tabular format:
   1. Scheduled date for first submittal.
   2. Specification Section number and title.
   3. Submittal category (action or informational).
   4. Name of subcontractor.
   5. Description of the Work covered.
   6. Scheduled date for Architect's final release or approval.

C. Preliminary Construction Schedule: Submit **one** opaque copies.
   1. Approval of cost-loaded preliminary construction schedule will not constitute approval of Schedule of Values for cost-loaded activities.

D. Preliminary Network Diagram: Submit **one** opaque copies, large enough to show entire network for entire construction period. Show logic ties for activities.

E. Contractor's Construction Schedule: Submit **two** opaque copies of initial schedule, large enough to show entire schedule for entire construction period.
   1. Submit an electronic copy of schedule.

F. CPM Reports: Concurrent with CPM schedule, **submit three** copies of each of the following computer-generated reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
   1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
   2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
   3. Total Float Report: List of all activities sorted in ascending order of total float.
   4. Earnings Report: Compilation of Contractor's total earnings from **commencement of the Work the Notice to Proceed** until most recent Application for Payment.

G. Daily Construction Reports: Submit **one** copies at **monthly** intervals.

H. Material Location Reports: Submit **one** copies at **monthly** intervals.

I. Field Condition Reports: Submit **one** copies at time of discovery of differing conditions.

J. Special Reports: Submit **one** copies at time of unusual event.

## 1.5 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.

B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to the Preliminary Construction Schedule and Contractor's Construction Schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.
3. Discuss constraints, including **phasing**, **work stages**, **area separations, and interim milestones**.
4. Review schedule for work of Owner's separate contracts.
5. Review time required for review of submittals and resubmittals.
6. Review requirements for tests and inspections by independent testing and inspecting agencies.
7. Review and finalize list of construction activities to be included in schedule.
8. Review submittal requirements and procedures.
9. Review procedures for updating schedule.

## 1.6 COORDINATION

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

B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
   1. Secure time commitments for performing critical elements of the Work from parties involved.
   2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

# PART 2 - PRODUCTS

## 2.1 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
   1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
   2. Initial Submittal: Submit concurrently with preliminary **bar-chart schedule**. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
      a. At Contractor's option, show submittals on the Preliminary Construction Schedule, instead of tabulating them separately.
   3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

## 2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

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

B. Time Frame: Extend schedule from date established for **the Notice to Proceed** to date of **Final** Completion.
   1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
   1. Activity Duration: Define activities so no activity is longer than **20** days, unless specifically allowed by Architect.
   2. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.

3. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
   1. Phasing: Arrange list of activities on schedule by phase.
   2. Work under More Than One Contract: Include a separate activity for each contract.
   3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
   4. Work Restrictions: Show the effect of the following items on the schedule:
      a. Coordination with existing construction.
      b. Limitations of continued occupancies.
      c. Use of premises restrictions.
      d. Provisions for future construction.
      e. Seasonal variations.
      f. Environmental control.
   5. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
      a. Subcontract awards.
      b. Submittals.
      c. Purchases.
      d. Mockups.
      e. Fabrication.
      f. Sample testing.
      g. Deliveries.
      h. Installation.
      i. Tests and inspections.
      j. Adjusting.
      k. Curing.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.

F. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.
   1. Refer to Division 01 Section "Payment Procedures" for cost reporting and payment procedures.
   2. Contractor shall assign cost to construction activities on the CPM schedule. Costs shall not be assigned to submittal activities unless specified otherwise but may, with Architect's approval, be assigned to fabrication and delivery activities. Costs shall be under required principal subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.
   3. Each activity cost shall reflect an accurate value subject to approval by Architect.
   4. Total cost assigned to activities shall equal the total Contract Sum.

G. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.

## 2.3 PRELIMINARY CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit preliminary horizontal bar-chart-type construction schedule within **seven** days of date established for **the Notice of Award**.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first **60** days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.4 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's Construction Schedule within **30** days of date established for **the Notice to Proceed**. Base schedule on the Preliminary Construction Schedule and whatever updating and feedback was received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require 3 months or longer to complete, indicate an estimated completion percentage in **10** percent increments within time bar.

2.5 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. Preliminary Network Diagram: Submit diagram within **14** days of date established for **the Notice to Proceed**. Outline significant construction activities for the first **60** days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's Construction Schedule using a computerized, time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than **30** days after date established for **the Notice to Proceed**.
    a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
4. Use "one workday" as the unit of time. Include list of nonworking days and holidays incorporated into the schedule.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
    a. Preparation and processing of submittals.
    b. Mobilization and demobilization.
    c. Purchase of materials.
    d. Delivery.
    e. Fabrication.
    f. Utility interruptions.
    g. Installation.
    h. Work by Owner that may affect or be affected by Contractor's activities.
    i. Testing.
2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
    a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

E. Initial Issue of Schedule: Prepare initial network diagram from a list of straight "early start-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.

2. Description of activity.
3. Principal events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the Schedule of Values).

F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

G. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.
1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
   a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
   b. Submit value summary printouts **[one week]** before each regularly scheduled progress meeting.

## 2.6 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (refer to special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. **Construction** Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial Completions and occupancies.
19. Substantial Completions authorized.

B. Material Location Reports: At **monthly** intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported

plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.

C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

## 2.7 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within **one** day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

# PART 3 - EXECUTION

## 3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At **monthly** intervals, update schedule to reflect actual construction progress and activities. Issue schedule **one week** before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate Actual Completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

**END OF SECTION 01 32 00**

# SECTION 01 33 00 - SUBMITTAL PROCEDURES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Sections include the following:
1. Division 01 Section "Payment Procedures" for submitting Applications for Payment and the Schedule of Values.
2. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
3. Division 01 Section "Quality Requirements" for submitting test and inspection reports and for mockup requirements.
4. Division 01 Section "Closeout Procedures" for submitting warranties.
5. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
6. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
7. Divisions 02 through 49 Sections for specific requirements for submittals in those Sections.

### 1.3 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect’s responsive action.

B. Informational Submittals: Written information that does not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

C. Field Samples: Full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.

D. Mockups: Full-size assemblies for review of construction, coordination, testing, or operation; they are not Samples.

### 1.4 SUBMITTAL PROCEDURES

A. General: Electronic copies of CAD Drawings of the Contract Drawings **will not** be provided by Architect for Contractor's use in preparing submittals unless a Waiver is provided by the Contractor.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed 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

C. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

D. Processing Time: Allow enough 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 twenty-one (21) 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 fourteen (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 twenty-one (21) days for initial review of each submittal.
    a. Steel may be submitted for sequential review.
5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow twenty-one (21) days for review of each submittal. Submittal will be returned to **Architect** before being returned to Contractor:
    a. Concurrent Consultant Review: Civil (Site and Site utilities, Structural (Steel and Concrete), Plumbing, Mechanical and Electrical.

E. Identification: Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information on label for processing and recording action taken:
    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name and address of Contractor.
    e. Name and address of subcontractor.
    f. Name and address of supplier.
    g. Name of manufacturer.
    h. Submittal number or other unique identifier, including revision identifier.
        1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).
    i. Number and title of appropriate Specification Section.
    j. Drawing number and detail references, as appropriate.
    k. Location(s) where product is to be installed, as appropriate.
    l. Other necessary identification.

F. Deviations: Highlight or otherwise specifically identify deviations from the Contract Documents on submittals.

G. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
2. Additional copies submitted for maintenance manuals will **not** be marked with action taken and will be returned.

H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.
1. Transmittal Form: Use facsimile of sample form provided at end of Section.
2. 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 label information as related submittal.

I. 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.
3. Resubmit submittals until they are marked "."

J. 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.

K. Use for Construction: Use only final submittals with mark indicating approval notation from Architect's action stamp taken by Architect.

## 1.5 CONTRACTOR'S USE OF ARCHITECT'S CAD FILES

A. General: At Contractor's written request, copies of Architect's CAD files will be provided to Contractor for Contractor's use in connection with Project, subject to the following conditions:
1. Contractor shall sign waiver form provided by Architect.

# PART 2 - PRODUCTS

## 2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
   a. Manufacturer's written recommendations.
   b. Manufacturer's product specifications.
   c. Manufacturer's installation instructions.
   d. Standard color charts.
   e. Manufacturer's catalog cuts.

f. Wiring diagrams showing factory-installed wiring.
g. Printed performance curves.
h. Operational range diagrams.
i. Mill reports.
j. Standard product operation and maintenance manuals.
k. Compliance with specified referenced standards.
l. Testing by recognized testing agency.
m. Application of testing agency labels and seals.
n. Notation of coordination requirements.

4. Submit Product Data before or concurrent with Samples.
5. Number of Copies: Submit six copies of Product Data, unless otherwise indicated. Architect will return two copies. Mark up and retain one returned copy as a Project Record Document.

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. Submittal of Architect's or Engineers's CAD Drawings are not permitted

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
   a. Dimensions.
   b. Identification of products.
   c. Fabrication and installation drawings.
   d. Roughing-in and setting diagrams.
   e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
   f. Shopwork manufacturing instructions.
   g. Templates and patterns.
   h. Schedules.
   i. Design calculations.
   j. Compliance with specified standards.
   k. Notation of coordination requirements.
   l. Notation of dimensions established by field measurement.
   m. Relationship to adjoining construction clearly indicated.
   n. Seal and signature of professional engineer if specified.
   o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches. Retain one of two subparagraphs below. First subparagraph assumes Architect and Contractor will make copies from opaque print.
3. Number of Copies: Submit two opaque (bond) copies of each submittal. Architect will return one copy.
4. Number of Copies: Submit six opaque copies of each submittal, unless copies are required for operation and maintenance manuals. Submit six copies where copies are required for operation and maintenance manuals. Architect will retain two copies; remainder will be returned

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 appropriate Specification Section.

E. 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.
   1. 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.
      Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

F. 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.
   1. Number of Samples: Submit two 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.
   2. No color selection shall be made until all samples of items requiring color selections have been submitted to the Architect. Color selections shall be submitted to the Contractor in a finish schedule.

G. 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.
   1. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned
      a. Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      b. 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.

H. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
   1. Type of product. Include unique identifier for each product.
   2. Number and name of room or space.
   3. Location within room or space.
   4. Number of Copies: Submit three copies of product schedule or list, unless otherwise indicated. Architect will return two copies.

I. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation" for Construction Manager's action.

J. Submittals Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

K. Application for Payment: Comply with requirements specified in Division 01 Section "Payment Procedures."

L. Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

M. 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.
4. Number of Copies: Submit three copies of subcontractor list, unless otherwise indicated. Architect will return one copies.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.
   1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Architect will not return copies.
   2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
   3. Test and Inspection Reports: Comply with requirements specified in Division 01 Section "Quality Requirements."
B. Coordination Drawings: Comply with requirements specified in Division 01 Section "Project Management and Coordination."
C. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
H. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
I. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
J. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
K. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
L. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
   1. Name of evaluation organization.
   2. Date of evaluation.
   3. Time period when report is in effect.
   4. Product and manufacturers' names.
   5. Description of product.
   6. Test procedures and results.
   7. Limitations of use.
M. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."

N. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

O. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

P. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

Q. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

R. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

S. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
   1. Preparation of substrates.
   2. Required substrate tolerances.
   3. Sequence of installation or erection.
   4. Required installation tolerances.
   5. Required adjustments.
   6. Recommendations for cleaning and protection.

T. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
   1. Name, address, and telephone number of factory-authorized service representative making report.
   2. Statement on condition of substrates and their acceptability for installation of product.
   3. Statement that products at Project site comply with requirements.
   4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
   5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   6. Statement whether conditions, products, and installation will affect warranty.
   7. Other required items indicated in individual Specification Sections.

U. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

V. Construction Comply with requirements specified in Division 01 Section "Photographic Documentation."

W. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Architect.
   1. Architect will not review submittals that include MSDSs and will return the entire submittal for resubmittal.

## 2.3 DELEGATED DESIGN

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

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three copies of a statement, signed and sealed by the responsible design professional, for each

product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

## PART 3 - EXECUTION

### 3.1 CONTRACTOR'S REVIEW

A. 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. 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. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.

C. 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.

D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

E. No submittal involving the selection of a color will be released until all colors are selected and approved by the Owner.

F. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

**Project Name Project Number**
Submittal/Shop Drawing Form

SMITHSINNETT architecture

| 1. Project Information | | 2. Transmittal | | 3. Tracking | | |
|---|---|---|---|---|---|---|
| Owner: | | Title: | | | Date: | Quantity: |
| Architect: | Smith Sinnett Architecture, P.A.<br>4601 Lake Boone Trail, Suite 3-C<br>Raleigh, North Carolina 27607<br>Tele: 919-781-8582<br>Fax: 919-781-3979 | | | Sub Sent | | |
| | | | | Contractor Receive | | |
| | | | | Contractor Sent | | |
| | | | | Architect Receive | | |
| Consultant: | | Specification Reference: | | Architect Sent | | |
| | | | | Consultant Receive | | |
| Contractor: | | Description: | | Consultant Send | | |
| | | | | Architect Receive | | |
| | | | | Architect Sent | | |
| Sub: | | | | Contractor Receive | | |
| | | | | Contractor Sent | | |
| | | | | Sub Receive | | |

Contractor's Stamp

Architect's Stamp

Consultant's Stamp

**END OF SECTION 01 33 00**

# SECTION 01 40 00 - QUALITY REQUIREMENTS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.

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

C. Related Sections include the following:
   1. Division 01 Section "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities.
   2. Divisions 02 through 49 Sections for specific test and inspection requirements.

### 1.3 DEFINITIONS

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

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

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

D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

E. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

G. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

H. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

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

J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
   1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

K. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

## 1.4 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

## 1.5 SUBMITTALS

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

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Description of test and inspection.
   3. Identification of applicable standards.
   4. Identification of test and inspection methods.

5. Number of tests and inspections required.
6. Time schedule or time span for tests and inspections.
7. Entity responsible for performing tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

C. Reports: Prepare and submit certified written reports that include the following:
1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

## 1.6 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
1. Requirement for specialists shall not supersede building codes and regulations governing the Work.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
   1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
   2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
   1. Contractor responsibilities include the following:
      a. Provide test specimens representative of proposed products and construction.
      b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
      c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
      d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
      e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
      f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
   2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

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

K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in Divisions 02 through 49.

## 1.7 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
   1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
   2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.

3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not. Cost for these services are included in the Contract Sum
   1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
      a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
   2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
   3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
   4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
   5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
   1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
   2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
   3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
   4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
   5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
   6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
   1. Access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.
   3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
   4. Facilities for storage and field curing of test samples.
   5. Delivery of samples to testing agencies.
   6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
   7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
   1. Schedule times for tests, inspections, obtaining samples, and similar activities.

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for the Notice to Proceed.

1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 ACCEPTABLE TESTING AGENCIES

A. Testing agency will be hired by and paid for by the Owner**.**

3.2 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:
   1. Date test or inspection was conducted.
   2. Description of the Work tested or inspected.
   3. Date test or inspection results were transmitted to Architect.
   4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.3 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
   2. Comply with the Contract Document requirements for Division 01 Section "Cutting and Patching."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

**END OF SECTION 01 40 00**

# SECTION 01 41 00 – SPECIAL INSPECTION SERVICES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Special Inspection services.

B. Certain structural components of the Project will be subject to the requirements for Special Inspections. Special Inspections will be applicable to the following specification sections:

1. Section 033000 Building Cast-In-Place Concrete
2. Section 042000 Unit Masonry
3. Section 051200 Structural Steel Framing
4. Section 053100 Steel Decking
5. Section 054000 Cold-Formed Metal Framing
6. Section 312000 Earth Moving

C. The Owner will procure and bear all costs of the Special Inspector and the Independant Testing Agencies, except as otherwise noted. The Special Inspector will be the manager of the Special Inspection process. The Special Inspector checks the certification of all other inspecting agents required by Special Inspections and coordinates their activities. The Special Inspector carries the exclusive responsibility for assuring that the inspections indicated are performed. The Statement of Special Inspections will be required by the Building Official as a condition for building permit issuance.

D. Requirements for Special Inspections are outlined in the Statement and Schedule of Special Inspections included at the end of this section.

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

E. Special Inspections are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.

F. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Quality Control" specifies requirements for repair and restoration of construction disturbed by inspection and testing activities.

### 1.3 RESPONSIBILITIES

A. Contractor Responsibilities: Contractor shall provide and include in the Contract Sum, inspections, tests, and other similar quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction except where they are specifically indicated to be the Owner's responsibility, or are provided by another identified entity.

1. 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.

    a. The Contractor shall correct deficiencies in work that inspections and laboratory test reports have indicated to be not in compliance with requirements.
    b. 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.

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

    a. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.

3. Associated Services: The Contractor shall 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:

    a. Provide access to the Work.
    b. Furnish incidental labor and facilities necessary to facilitate inspections and tests.
    c. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
    d. Provide and maintain for the sole use of the Special Inspector or Special Inspectors adequate facilities for safe storage and proper curing of test samples on the Project Site.
    e. Provide the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
    f. Provide security and protection of samples and test equipment at the Project Site.
    g. The Contractor shall designate a representative (the superintendent or an assistant to the superintendent) who shall be the direct point-of-contact with the Special Inspector during each phase of the work. Discrepancies noted during the progress of the work will be reported to the Contractor's representative for corrective action. Communications given by the Special Inspector to the Contractor's representative shall be as binding as if given to the Contractor.

B. Special Inspector Responsibilities:

1. The Special Inspector shall conduct and interpret tests, state in each report whether test specimens comply with requirements, specifically state any deviations therefrom, and record work required and performed to correct deficiencies.
2. The Special Inspector will keep records of all inspection and tests which will be furnished to the Building Official, the Architect, and the Structural Engineer of Record.
3. The Special Inspector shall notify the Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services. All discrepancies will be

brought to the immediate attention of the Contractor for correction. If discrepancies are not corrected, the discrepancies will be brought to the attention of the Building Official and the Structural Engineer of Record.

4. A final report documenting completion of all required special inspections and corrections of any discrepancies noted will be submitted to the Building Official by the Special Inspector prior to, and as a condition of, issuance of the Certificate of Use and Occupancy.
5. The Special Inspector shall not perform any duties of the Contractor
6. The Special Inspector shall not release, revoke, alter, decrease or increase the Contract Document requirements.

C. Indepedant Testing Agency Responsibilities: 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. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report of each test, inspection, and similar quality-control service through Contractor.
5. Shall not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.

D. Coordination: The Contractor and each agency engaged to perform inspection, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition the Contractor and each agency shall 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.

## 1.4 SUBMITTALS

A. The Special Inspector and the Independent Testing Agencies shall submit a certified written report of each inspection, test, or similar service to the Architect.

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 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.

1.5 QUALITY ASSURANCE

A. Qualification for Special Inspector: The Special Inspector shall be a Registered Professional Engineer, Licensed in the State of North Carolina, experienced in performing special inspections and shall be approved by the Building Offical and the Architect. The credentials of all Inspectors and testing technicians shall be provided if requested.

B. Qualifications for Independant Testing Agencies: Engage independant inspection and testing agencies, that are prequalified as complying with the American Council of Independent Laboratories' "Recommended Requirements for Independent Laboratory Qualification" and that specialize in the types of inspections and tests to be performed.

1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the state where the Project is located.

2. Each independent inspection and testing agency engaged on the Project shall demonstrate that it has the experience and capability to conduct the required field and laboratory testing without delaying the progress of the work. The minimum requirements shall be as follows:

a. Reinforced Concrete Testing – ACI-CFTT, ACI-STT, ACI-LTT, NICET-CT

b. Reinforced Concrete Inspection – ACI-CCI, ICC-RCSI

c. Welding – AWS-CWI

d. Non-Destructive Testing - ASNT

e. Structural Masonry – ICC-SMSI

f. Structural Steel and Welding – ICC-SWSI, AWS/AISC-SSI

g. Soils Testing – NICET-ST, NICET-GET

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 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.

**END OF SECTION 01 41 00**

# SECTION 01 42 00 - REFERENCES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "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.

J. "Installer": An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, who performs a particular construction activity including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.
   1. The term "experienced," when used with the term "installer," means having successfully completed a minimum of 5 previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.
   2. Trades: Using terms such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as

"carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

3. Assigning Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in those operations. The specialists must be engaged for those activities, and their assignments are requirements over which the Contractor has no option. However, the ultimate responsibility for fulfilling contract requirements remains with the Contractor.

K. "Testing Agencies": A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

L. This requirement shall not be interpreted to conflict with enforcing building codes and similar regulations governing the Work. It is also not intended to interfere with local trade-union jurisdictional settlements and similar conventions.

## 1.3 SPECIFICATION FORMAT AND CONTEC EXPLANATION

A. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's "MasterFormat 2004" numbering system.

B. Specification Content: These Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

C. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated as the sense requires. Singular words shall be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.

D. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor or by others when so noted.

E. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

## 1.4 SUBMITTALS

A. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

## 1.5 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. Conflicting Requirements: Where compliance with 2 or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different but apparently equal to the Architect for a decision before proceeding.

1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to the Architect for a decision before proceeding.

C. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.

D. 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.

E. Abbreviations and Acronyms for Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

1.6 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale Research's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

**END OF SECTION 01 42 00**

# SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Sections include the following:
1. Division 01 Section "Summary" for limitations on utility interruptions and other work restrictions.
2. Division 01 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.

### 1.3 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

### 1.4 USE CHARGES

A. General: Cost or use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Water Service: CONTRACTOR WILL pay all water service connection expenses or charges for water used by all entities for construction operations. CONTRACTOR WILL pay for actual water use charges until Substantial Completion.

C. Electric Power Service: CONTRACTOR WILL pay all electric power service use charges for electricity used by all entities for construction operations. CONTRACTOR WILL pay for actual electrical use charges until Substantial Completion.

### 1.5 SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

1.6 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.7 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of construction personnel. Keep office clean and orderly. Office shall be used by the Owner and Architect as necessary. Furnish and equip offices as follows:
1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- square tack board.
3. Drinking water and private toilet.
4. Coffee machine and supplies.
5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
6. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

### 3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.
1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Water Service: Use of Owner's existing water service facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
1. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.

C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
1. Use of Owner's existing toilet facilities will be not be permitted

D. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

E. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

F. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
1. Install electric power service overhead unless otherwise indicated.
Connect temporary service to Owner's existing power source, as directed by Owner.

G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Install lighting for Project identification sign.

H. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

## 3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
1. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet of building lines. Comply with NFPA 241.
2. Locate, and relocate if necessary, construction support facilities to limit site disturbance as indicated in Section 01 10 00 Summary.
3. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

C. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

D. Project Identification and Temporary Signs: Provide Project identification and other signs. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.
1. Provide temporary, directional signs for construction personnel and visitors.
2. Maintain and touchup signs so they are legible at all times.

E. Project Identification and Temporary Signs:
1. General: Prepare project identification and other temporary signs of the size and with graphic content indicated; install at location approved by Owner and Architect. Support on posts or framing of treated wood or steel. Maintain signs to properly inform the public and persons seeking entrance to the project. Do not permit installation of unauthorized signs that are visible outside the site.
2. Project Identification Signs: Engage an experienced sign company to apply graphics in a neat professional manner. Comply with details and notations indicated.
3. Design and format of project identification sign shall be provided by the Architect.
4. Information required to be on the sign shall be as follows: Refer to sign elevation at end of this section.
5. Sign shall be double sided (two separate 3/4" marine plywood faces on either side of two 4"x4" posts, sign standing vertically with 8" dimension up), 4' x 8' in size with a maximum of 4 colors.

F. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction.

G. Burning of any materials including but not limited to construction debris on site is prohibited.

## 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
1. Comply with work restrictions specified in Division 01 Section "Summary."

B. Temporary Erosion and Sedimentation Control: Comply with requirements specified in Division 31 Section "Site Clearing."

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
   1. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Stormwater Control: Comply with authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

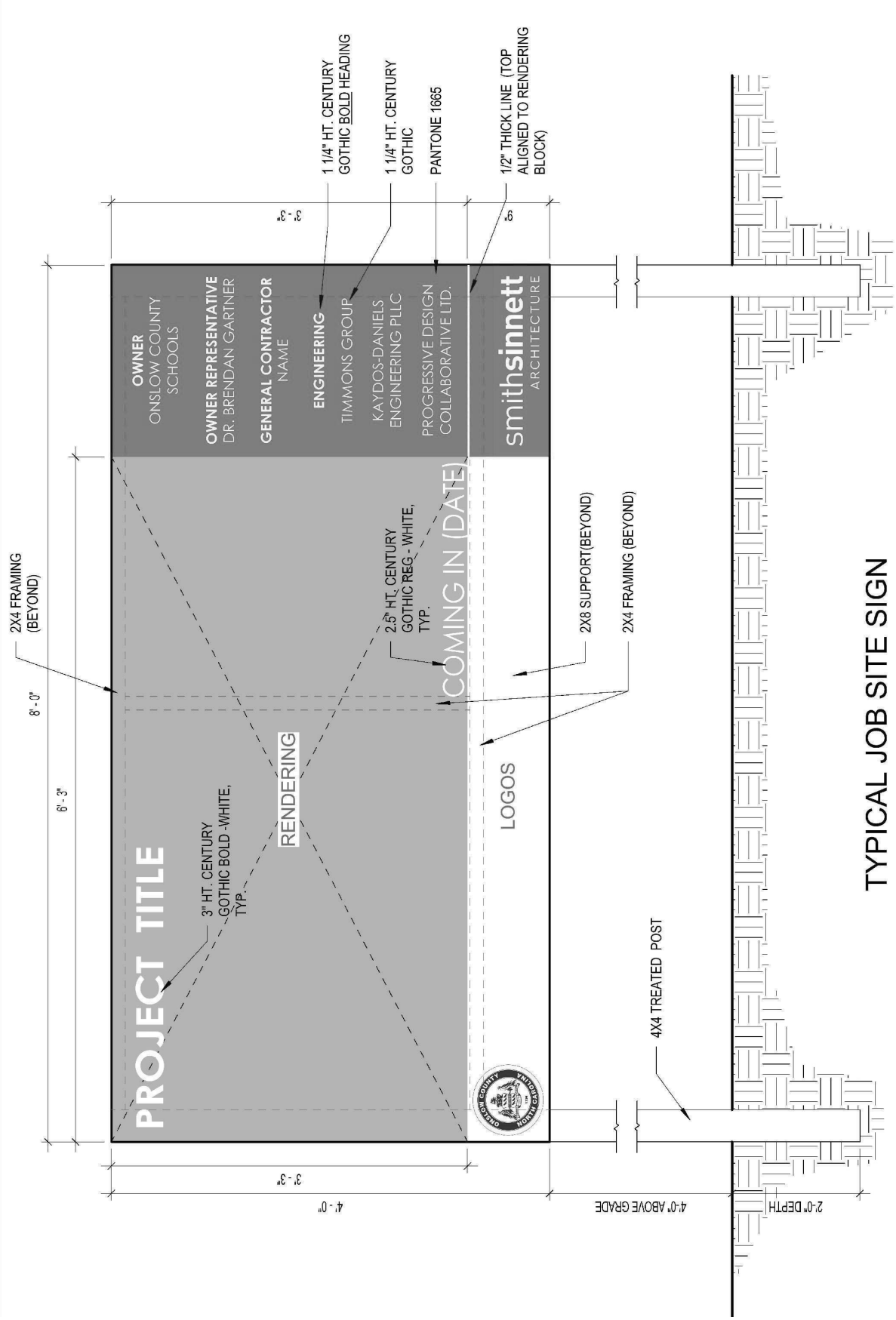
E. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.

F. Site Enclosure Fence: Before construction of building additions begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering new construction area, except by entrance gates.
   1. Extent of Fence: As required to enclose portion determined sufficient to accommodate construction operations.

G. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
   1. Prohibit smoking in construction areas.
   2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
   3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

## 3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
B. Burning of any materials including but not limited to construction debris on site is prohibited.
C. Maintenance: Maintain facilities in good operating condition until removal.
   1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Final Acceptance.
E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Final Acceptance. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
   1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
   2. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
   3. At Final Acceptance, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."


TYPICAL JOB SITE SIGN
PROJECT TITLE
RENDERING
COMING IN (DATE)
LOGOS
OWNER
ONSLOW COUNTY SCHOOLS
OWNER REPRESENTATIVE
DR. BRENDAN GARTNER
GENERAL CONTRACTOR
NAME
ENGINEERING
TIMMONS GROUP
KAYDOS-DANIELS ENGINEERING PLLC
PROGRESSIVE DESIGN COLLABORATIVE LTD.
smithsinnett
ARCHITECTURE
1 1/4" HT. CENTURY GOTHIC BOLD HEADING
1 1/4" HT. CENTURY GOTHIC
PANTONE 1665
1/2" THICK LINE (TOP ALIGNED TO RENDERING BLOCK)
3" HT. CENTURY GOTHIC BOLD -WHITE, TYP.
2.5" HT. CENTURY GOTHIC REG - WHITE, TYP.
2X4 FRAMING (BEYOND)
2X8 SUPPORT(BEYOND)
2X4 FRAMING (BEYOND)
4X4 TREATED POST
8' - 0"
6' - 3"
3' - 3"
4' - 0"
4'-0" ABOVE GRADE
2'-0" DEPTH

**END OF SECTION 01 50 00**

# SECTION 01 60 00 - PRODUCT REQUIREMENTS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This 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; product substitutions; and comparable products.

B. Related Sections include the following:
1. Division 01 Section "Allowances" for products selected under an allowance.
2. Division 01 Section "Alternates" for products selected under an alternate.
3. Division 01 Section "References" for applicable industry standards for products specified.
4. Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.
5. Divisions 02 through 49 Sections for specific requirements for warranties on products and installations specified to be warranted.

### 1.3 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," 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 other named manufacturers.

1.4 SUBMITTALS

A. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
   1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
   2. Form: Tabulate information for each product under the following column headings:
      a. Specification Section number and title.
      b. Generic name used in the Contract Documents.
      c. Proprietary name, model number, and similar designations.
      d. Manufacturer's name and address.
      e. Supplier's name and address.
      f. Installer's name and address.
      g. Projected delivery date or time span of delivery period.
      h. Identification of items that require early submittal approval for scheduled delivery date.

B. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.
   1. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.

C. Completed List: Within 60 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.

D. Architect's Action: Architect will respond in writing to Contractor within 15 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.

E. Substitution Requests: The Architect will consider requests for substitution if received within 10 consecutive calendar days prior to bid. Requests received more than 10 consecutive calendar days prior to bid will be rejected at the discretion of the Architect. Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Substitution Request Form:
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
      a. Statement indicating why specified material or product cannot be provided.
      b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
      c. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
      d. Samples, where applicable or requested.
      e. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
      f. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
      g. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
      h. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.

i. Cost information, including a proposal of change, if any, in the Contract Sum.
j. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
k. 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.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 days 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.

F. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
   a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
   Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.

G. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

## 1.5 QUALITY ASSURANCE

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

## 1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

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 ensure compliance with the Contract Documents and to ensure 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. Store cementitious products and materials on elevated platforms.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

## 1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
3. Refer to Divisions 02 through 49 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

# PART 2 - PRODUCTS

## 2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.

6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:
1. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
2. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.
a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items. Where specifications include the phrase “custom color” or similar phrase, provide a custom color not in the manufacturer’s product line.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF PRODUCTS

A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.

B. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Final Inspection.

**END OF SECTION 01 60 00**

# SECTION 01 71 23 - FIELD ENGINEERING

## 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. Land survey work.

B. Related Sections:
   1. Division 01 Section "Product Management and Coordination" for procedures for coordinating field engineering with other construction activities.
   2. Division 01 Section "Submittal Procedures" for submitting Project record surveys.
   3. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents and recording of Owner-accepted deviations from indicated lines and levels.

### 1.3 SUBMITTALS

A. Certificates: Submit a certificate signed by the land surveyor or professional engineer certifying the location and elevation of improvements.

B. Project Record Documents: Submit a record of Work performed and record survey data as required under provisions of "Submittals" and "Project Closeout" Sections.

### 1.4 QUALITY ASSURANCE

A. Surveyor Qualifications: Engage a land surveyor registered in North Carolina, to perform required land-surveying services.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Verify layout information shown on the Drawings, in relation to the property survey and existing benchmarks, before proceeding to lay out the Work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.

B. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points or requirements to relocate reference points because of necessary changes in grades or locations.

C. Promptly replace lost or destroyed Project control points. Base replacements on the original survey control points. Establish and maintain a minimum of 2 permanent benchmarks on the site, referenced to data established by survey control points. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

D. Existing Underground Utilities and Equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities and other construction. Prime Contractor and all subcontractors shall field locate all underground services whether shown on drawings or not, including, but not limited to the following: utilities, underground wires, fiber optic lines, cables, conduits, and pipes, prior to initiating any excavation on any area of the proposed site. Provide and pay for underground utility locator service, metal detectors and hand digging as necessary to satisfy above requirement. Provide drawing prior to commencing work signed by the locator service that delineates the underground services. Locator service shall field locate all services with high visibility paint. Maintain ground markings during the course of work and stay clear of underground service until work that may damage underground services is complete. Prime Contractor (s) and their subcontractors shall be responsible for utility services damaged during construction and shall repair at their own expense any utility services damaged by their work. Repair within 24 hours or less.

E. Prior to construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping.

3.2 PREFORMANCE

A. Work from lines and levels established by the property survey. Establish benchmarks and markers to set lines and levels at each story of construction and elsewhere as needed to locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale Drawings to determine dimensions. Advise entities engaged in construction activities of marked lines and levels provided for their use. As construction proceeds, check every major element for line, level, and plumb.

B. Surveyor's Log: Maintain a surveyor's log of control and other survey work. Make this log available for reference. Record deviations from required lines and levels, and advise the Architect when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected. On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and site work.

C. Site Improvements: Locate and lay out site improvements, including pavements, stakes for grading, fill and topsoil placement, utility slopes, and invert elevations.

D. Building Lines and Levels: Locate and lay out batter boards for structures, building foundations, column grids and locations, floor levels, and control lines and levels required for mechanical and electrical work.

E. Existing Utilities: Furnish information necessary to adjust, move, or relocate existing structures, utility poles, lines, services, or other appurtenances located in or affected by construction. Coordinate with local authorities having jurisdiction.

**END OF SECTION 01 71 23**

# SECTION 01 73 29 - CUTTING AND PATCHING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. Related Sections include the following:
1. Divisions 2 through 49 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

### 1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

### 1.4 RESPONSIBILITIES

A. General: The Contractors shall recognize that cutting and patching work is historically and typically difficult to coordinate. The Contractors shall cooperate with each other and the Architect in coordinating the cutting and patching work on this project to overcome these historical and typical problems.

B. Cutting and patching of completed new construction required due to out of sequence construction and/or improper coordination is the responsibility of the Contractor responsible for the out of sequence construction or improper coordination. Cutting and patching of new construction for these purposes shall be accomplished by the Contractor for General Work and shall be paid for by the Contractor responsible.

C. Contractor for General Work shall cooperate with Architect and other Contractors to accomplish this cutting and patching with minimal disruption to construction.

### 1.5 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.

3. Products: List products to be used and firms or entities that will perform the Work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.
6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

## 1.6 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include but are not limited to:
1. Primary operational systems and equipment.
2. Air or smoke barriers.
3. Fire-suppression systems.
4. Mechanical systems piping and ducts.
5. Control systems.
6. Communication systems.
7. Conveying systems.
8. Electrical wiring systems.
9. Operating systems of special construction in Division 13 Sections.

C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety. Miscellaneous elements include but are not limited to the following:
1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Exterior curtain-wall construction.
4. Equipment supports.
5. Piping, ductwork, vessels, and equipment.
6. Noise- and vibration-control elements and systems.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.7 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
   1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
   1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
   2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. 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.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete or Masonry**:** Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
   5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
   6. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
      a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
      b. Restore damaged pipe covering to its original condition.
   3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
      a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
   4. Ceilings: Patch, repair, or 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.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

**END OF SECTION 01 73 29**

# SECTION 01 77 00 - CLOSEOUT PROCEDURES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Inspection procedures.
   2. Warranties.
   3. Final cleaning.

B. Related Sections include the following:
   1. Division 01 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
   2. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
   3. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
   4. Divisions 02 through 49 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

### 1.3 SUBMITTALS

A. All closeout submittals, including but not limited to, Maintenance and Operation Manual, Warranties, Bonds, additional closeout submittals required by the Owner or Architect and additional requirements stated in the specifications shall be submitted in the following way:
   1. Bind all closeout documents in one uniform color, heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate all contents in 75% of the binder’s width and allow of 25% free space for future items, and sized to receive 8-1/2-by-11-inch paper.
   2. Provide heavy paper dividers with plastic-covered tabs for each separate section. Mark tab to identify the content of that section. Identify each binder on the front and spine with the typed or printed title of the Binder, Project name, and name of Contractor.

### 1.4 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
   1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
   2. Advise Owner of pending insurance changeover requirements.
   3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents (marked up and signed plans and specifications), operation and maintenance manuals, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect 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.

## 1.5 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect 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.

## 1.6 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order.
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.
   d. Name of Contractor.
   e. Page number.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

## PART 3 - EXECUTION

### 3.1 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
   1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
   2. 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.
   3. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
   4. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
   5. Remove tools, construction equipment, machinery, and surplus material from Project site.
   6. Remove snow and ice to provide safe access to building.
   7. 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.
   8. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
   9. Sweep concrete floors broom clean in unoccupied spaces.
   10. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
   11. Remove labels that are not permanent.
   12. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
       a. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
   13. Replace parts subject to unusual operating conditions.
   14. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

15. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
16. Leave Project clean and ready for occupancy.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

**END OF SECTION 01 77 00**

# SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory.
   2. Emergency manuals.
   3. Operation manuals for systems, subsystems, and equipment.
   4. Maintenance manuals for the care and maintenance of products, materials, finishes, systems and equipment.

B. Related Sections include the following:
   1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
   2. Division 01 Section "Closeout Procedures" for submitting operation and maintenance manuals.
   3. Division 01 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
   4. Divisions 02 through 49 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

### 1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

### 1.4 SUBMITTALS

A. Initial Submittal: Submit 2 draft copies of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect will return one copy of draft and mark whether general scope and content of manual are acceptable.

B. Final Submittal: Submit one copy of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.
   1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

1.5 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:
1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with 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 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name, address, and telephone number of Contractor.
6. Name and address of Architect.
7. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
   1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
      a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
      b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
   2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
   3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
   4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
   5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
      a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
      b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

## 2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:
   1. Type of emergency.
   2. Emergency instructions.
   3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
   1. Fire.
   2. Flood.
   3. Gas leak.
   4. Water leak.
   5. Power failure.
   6. Water outage.
   7. System, subsystem, or equipment failure.
   8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:
   1. Instructions on stopping.
   2. Shutdown instructions for each type of emergency.
   3. Operating instructions for conditions outside normal operating limits.
   4. Required sequences for electric or electronic systems.
   5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Contractor is 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.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:
1. Product name and model number.

2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

## 2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
1. Standard printed maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training videotape, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

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.

I. Include procedures to follow and required notifications for warranty claims.

## PART 3 - EXECUTION

### 3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
   1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
   1. Do not use original Project Record Documents as part of operation and maintenance manuals.
   2. Comply with requirements of newly prepared Record Drawings in Division 01 Section "Project Record Documents."
   3. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

**END OF SECTION 01 78 23**

# SECTION 01 78 36 - WARRANTIES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

1. 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. Warranty Requirements.
B. Related Sections:
   1. Division 01 Section "Closeout Procedures" for specifies contract closeout procedures.
   2. Division 01 Section "Submittal Procedures" for specifies procedures for submitting warranties.
   3. Divisions 02 through 49 Sections for specific closeout and special cleaning requirements for the Work in those Sections.
C. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.
   The General Contractor and each subcontractor are responsible for warranties related to its own contract.

### 1.3 DEFINITIONS

A. Standard product warranties: Preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
B. Special warranties: Written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

### 1.4 WARRANTY

A. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.
B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefitted from use of the Work through a portion of its anticipated useful service life.
D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

E. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

F. **Minimum One Year Warranty on All Work**: A one year unconditional non-prorated warranty shall be provided for all work, material and equipment on this project. Any and all defective work, material and equipment shall be corrected by the Contractor at his own expense during this one year period. Defective work, material or equipment including other related or adjacent work damaged directly or indirectly by defective work, material or equipment shall be corrected promptly and within 24 hours during this period of time unless emergencies require a more prompt repair by the Contractor. Longer term warranties shall apply where noted but shall be in addition to this warranty and not be used as a substitute for this warranty.

1.5 OTHER WARRANTIES

A. In addition to a one year warranty on all work, the contract documents contain other warranties. The Contractor shall include these written warranties in all submittal documents and closeout documents.

1.6 SUBMITTALS

A. Submit written warranties to the Architect. All warranties shall be dated from Final Completion or Beneficial Occupancy.

B. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner, through the Architect, for approval prior to final execution.

C. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual. Services in this article may not be allowed for publicly funded projects.

D. 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.

E. Form of Submittal: Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
   1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
   2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
   3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

F. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

**END OF SECTION 01 78 36**

# SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.

B. Related Sections include the following:
   1. Division 01 Section "Closeout Procedures" for general closeout procedures.
   2. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
   3. Divisions 02 through 49 Sections for specific requirements for Project Record Documents of the Work in those Sections.

### 1.3 SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit **one** set of marked-up Record Prints.
   2. Number of Copies: Submit copies of Record Drawings as follows:
      a. Final Submittal: Submit **one** set(s) of marked-up Record Prints, **[one]** set(s) of Record.

B. Record Specifications: Submit **one mark up copy** of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit **two copies** of each Product Data submittal.
   1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

## PART 2 - PRODUCTS

### 2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings on the job site at all times for the duration of the project.
   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 prepare the 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 understandable drawing technique.
c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

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 or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
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. Identification: As follows:
      a. Project name.
      b. Date.
      c. Designation "PROJECT RECORD DRAWINGS."
      d. Name of Architect.
      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. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
   3. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
   4. Note related Change Orders and Record Drawings where applicable.

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.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents 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 reference during normal working hours.

**END OF SECTION 01 78 39**

# SECTION 01 79 00 - DEMONSTRATION AND TRAINING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment.
   2. Training in operation and maintenance of systems, subsystems, and equipment.
   3. Demonstration and training video.

B. Related Sections include the following:
   1. Division 01 Section "Project Management and Coordination" for requirements for preinstruction conferences.
   2. Divisions 02 through 49 Sections for specific requirements for demonstration and training for products in those Sections.

### 1.3 SUBMITTALS

A. Instruction Program: Submit **two** copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
   1. At completion of training, submit **one** complete training manual(s) for Owner's use.

B. Demonstration and Training Video: Submit **two** copies within **seven** days of end of each training module.
   1. Identification: On each copy, provide an applied label with the following information:
      a. Name of Project.
      b. Name and address of photographer.
      c. Name of Architect.
      d. Name of Contractor.
      e. Date was recorded.
      f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

C. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video. Include name of Project and date of video on each page.

### 1.4 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 Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Photographer Qualifications:
   1. A professional photographer who is experienced photographing construction projects.
   2. Phone or other video and audio recording device capable of adequately recording both adequately for future instruction and deemed of adequate quality by the owner and Architect post production.

D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
   1. Inspect and discuss locations and other facilities required for instruction.
   2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
   3. Review required content of instruction.
   4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

## 1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

# PART 2 - PRODUCTS

## 2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
   1. Motorized doors, including overhead doors.
   2. Fire-protection systems, including fire alarm.
   3. Intrusion detection systems.
   4. Heat generation, including pumps and piping.
   5. Refrigeration systems, including chillers, condensers, pumps and distribution piping.
   6. HVAC systems, including air-handling equipment, air distribution systems and terminal equipment and devices.
   7. HVAC instrumentation and controls.
   8. Electrical service and distribution, including transformers, switchboards, panelboards, uninterruptible power supplies and motor controls.
   9. Packaged engine generators, including transfer switches.
   10. Lighting equipment and controls.
   11. Communication systems, including intercommunication, surveillance, clocks and programming, voice and data and television equipment.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:
   1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
      a. System, subsystem, and equipment descriptions.

b. Performance and design criteria if Contractor is delegated design responsibility.
c. Operating standards.
d. Regulatory requirements.
e. Equipment function.
f. Operating characteristics.
g. Limiting conditions.
h. Performance curves.

2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Project Record Documents.
   e. Identification systems.
   f. Warranties and bonds.
   g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.
5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.
8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.

d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.
B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. 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. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
   2. Owner will furnish an instructor to describe Owner's operational philosophy.
   3. 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 Architect, with at least seven days' advance notice.
D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
E. Cleanup: Collect used and leftover educational materials and. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO

A. General: Engage a qualified commercial photographer to record demonstration and training video. In lieu of a commercial photographer a phone or other quality recording device may be substituted that can adequately record both audio and video may be substituted as long as sufficient information is recorded. Quality of the recording to be deemed sufficient based on the Owner and Architect post production.. Should the recording be deemed insufficient based on video or audio quality, the training video shall be redone at no expense to the owner until an approved video/audio recording can be provided by the contractor. 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 Format: Provide high-quality video format capable of running on any typical computer system.
C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.
D. Narration: Describe scenes by audio narration by microphone. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

**END OF SECTION 01 79 00**

# SECTION 02 4113 - SELECTIVE SITE DEMOLITION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

### 1.2 SUMMARY

A. This Section includes the following:

1. Demolition and removal of existing asphalt and/or concrete pavement, concrete and/or asphalt walks, curbs and gutters, and other exterior site items indicated or not indicated which interfere with the Work.
2. Removal and/or relocation of existing underground utilities.
3. Removal and disposal of existing sanitary sewer pipe, water pipe, storm drainage pipe and appurtenances indicated. Filling of existing pipes to be abandoned in place.
4. Removal and replacement of fencing and playground equipment.
5. Removal and relocation of existing light poles.
6. Removal and disposal of material from dump areas.

### 1.3 DEFINITIONS

A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner's property.

B. Remove and Salvage: Items indicated to be removed and salvaged remain the Owner's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to Owner's designated storage area.

C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations indicated.

D. Existing to Remain: Protect items indicated to remain against damage and soiling. When permitted by the Architect, items may be removed to a suitable, protected storage location and then cleaned and reinstalled in their original locations.

### 1.4 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Owner's property, remove demolished materials from the site with further disposition at the Contractor's option.

B. Storage or sale of removed items or materials on-site will not be permitted.

C. Historical items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to the Owner, which may be encountered, remain the Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to the Owner.

1.5 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by the Work.

B. Record drawings at Project closeout.

1. Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.

C. Proposed dust-control measures.

D. Schedule of selective demolition activities indicating the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.

2. Interruption of utility services.

3. Coordination for shutoff, capping, and continuation of utility services.

4. Detailed sequence of selective demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.

5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

6. Locations of temporary partitions and means of egress.

E. Inventory of items to be removed and salvaged or turned over to Owner.

F. Landfill records indicating receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: All work shall comply with Federal, State and Local laws and regulations concerning hauling and disposal of demolition debris.

B. Notify the proper agencies prior to the start of work and obtain all necessary permits for this work.

1.7 PROJECT CONDITIONS

A. Owner assumes no responsibility for actual condition of items or structures to be demolished. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner to the extent practical. However, minor variations may occur due to Owner’s removal and salvage operations prior to the start of demolition work.

B. The location of existing underground utilities indicated is approximate only. Field locate all existing underground utilities in the area of work, regardless of whether or not they are indicated. Call NC one call at 1-800632-4949 prior to the start of demolition work for assistance in the location of existing underground utilities.

C. Should charted, uncharted or incorrectly charted utilities be encountered during demolition, contact the Architect immediately for instructions. Cooperate with Owner and utility companies to keep services and facilities in operation.

D. Do not interrupt existing utilities serving facilities occupied and used by the Owner and others, except when permitted in writing by the Owner. Provide acceptable temporary utility service as required to maintain Owner’s operations.

1.8 SCHEDULING

A. Owner will occupy portions of the building immediately adjacent to the Work. Conduct selective demolition so that the Owner's operations will not be disrupted. Provide not less than 72 hours notice to Owner of activities that will affect Owner's operations.

B. Arrange selective demolition schedule so as not to interfere with Owner's on-site operations.

C. Notify and coordinate any required relocation and/or removal of existing underground utilities, poles, meters or other above ground appurtenances with the appropriate utility company (i.e. power, telephone, cable and natural gas/propane) prior to the start of selective demolition work.

1.9 PAYMENT FOR UTILITY REMOVAL / RELOCATIONS

A. Electric Service – The Owner will pay for the relocation of

B. Phone Service

C. Cable Television

D. Gas

E. Fiber Optic Lines

F. Petroleum Pipelines

1.10USE OF EXPLOSIVES

A. Do not use explosives to perform selective site demolition work.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 EXAMINATION

A. Call NC one call at 1-800632-4949 prior to the start of demolition work for assistance in the location of existing underground utilities. Field locate all existing underground utilities in the area of work, regardless of whether or not they are indicated.

B. Should uncharted or incorrectly charted existing utilities be identified, contact the Architect immediately for instructions. Provide a scale drawing with the location of the uncharted or incorrectly charted utilities for use by the Architect in preparing additional direction.

C. Verify that utilities indicated as removed, abandoned and/or relocated have been disconnected and capped.

D. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

E. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged and turned over to the Owner.

3.2 PROTECTION OF PERSONS AND PROPERTY

A. Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

B. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

C. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around selective demolition area.

1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.

2. Protect existing site improvements, appurtenances, and landscaping to remain.

D. Barricade areas of demolition occurring as part of this work, and post with warning lights as required by authorities having jurisdiction.

E. Protect structures, buildings, utilities, walks, pavements, existing vegetation and other facilities to remain from damage caused by settlement, lateral movement, undermining, washout and other hazards created by demolition operations.

## 3.3 POLLUTION CONTROLS

A. Perform all work in accordance with the requirements of the latest edition of the North Carolina Erosion and Sediment Control Planning and Design Manual and those of the local Erosion Control official.

B. Clean adjacent structures and improvements of dust, dirt, and debris caused by the Work. Return adjacent areas to condition existing before start of selective demolition.

## 3.4 DEMOLITION OF EXISTING FACILITIES

A. Electric Service

1. Coordinate the removal and/or relocation of existing utilities with the Local Power Company.

2. Contact the Local Power Company Representative to arrange for required removal and/or relocation of existing service.

B. Phone Service

1. Coordinate the removal and/or relocation of existing utilities with the Local Phone Company.

2. Contact the Local Phone Company Representative to arrange for required removal and/or relocation of existing service.

C. Cable Television

1. Coordinate the removal and/or relocation of existing utilities with the Local Cable Company.

2. Contact the Local Cable Company Representative to arrange for required removal and/or relocation of existing service.

D. Gas

1. Coordinate the removal and/or relocation of existing utilities with the Local Gas Company.

2. Contact the Local Gas Company Representative to arrange for required removal and/or relocation of existing service.

E. Fiber Optic Lines

1. Coordinate the removal and/or relocation of existing utilities with the Local Fiber Optic Company.

2. Contact the Local Fiber Optic Company Representative to arrange for required removal and/or relocation of existing service.

F. Petroleum Pipelines

1. Coordinate the removal and/or relocation of existing utilities with the Local Petroleum Pipeline Company.
2. Contact the Local Petroleum Pipeline Company Representative to arrange for required removal and/or relocation of existing service.

G. Utilities

1. Coordinate the removal and/or relocation of existing utilities with the appropriate utility companies.
2. Remove existing utilities as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and to local jurisdictional codes.
3. Provide adequate means of support and protection during demolition and other construction operations for existing utilities that are to remain in place. Repair utilities damaged by construction operations to the satisfaction of the utility owner.

H. Asphalt Pavement

1. Remove asphalt concrete pavement by sawcutting to the full depth of the pavement. Provide neat sawcuts at the limits of pavement removal indicated.

I. Concrete Pavement, Walks and Curbs

1. Remove concrete pavement and walks to the nearest joint. Sawcut concrete if joints are not present adjacent to the area of demolition.
2. Sawcut concrete along straight lines to a depth of not less than 2 inches. Break out remainder of concrete, provided that the broken area is concealed in the finished work, and the remaining concrete is sound. At locations where the broken face cannot be concealed, grind smooth or sawcut entirely through concrete.

J. Light Poles

1. Remove and relocate light poles as indicated. If light poles are owned by a public utility, coordinate the relocation with them.

K. Fencing

1. Remove existing fencing as indicated on the drawings.
2. Turn fencing materials removed over to the Owner.

L. Playground Equipment

1. Remove, store and protect existing playground equipment interfering with proposed construction.
2. Turn play equipment over to the Owner for reinstallation following the completion of construction in the area.

## 3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Do not burn demolished materials or debris.

C. Transport and legally dispose of demolished materials off of Owner's property.

3.6 CLEANUP AND REPAIR

A. Upon completion of demolition work remove all tools, equipment and demolition materials from site. Remove demolition work area protection and leave areas clean.

B. Repair any demolition performed in excess of that required. Return elements of construction and surfaces to remain to the condition existing prior to the start of construction. Repair adjacent construction or surfaces soiled or damaged by demolition work.

END OF SECTION 02 4113

## SECTION 02 32 00 – GEOTECHNICAL INVESTIGATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Reports of Detailed Subsurface Investigations provided.
   1. Geotechnical Engineering Report dated May 24, 2023 (50 Pages).
   2. Report of Seasonal High Water Table Estimation and Infiltration Testing dated May 16, 2023 (6 Pages).

**END OF SECTION 02 32 00**

# ECS Southeast, LLP

Geotechnical Engineering Report

**Northwoods Park Middle School Addition**

Jacksonville, Onslow County, North Carolina

ECS Project Number 22:33137

May 24, 2023

May 24, 2023

Mr. Dusty Oliver
Onslow County Schools
200 Broadhurst Road
Jacksonville, NC 28541

ECS Project No. 22:33137

Reference: Geotechnical Engineering Report
**Northwoods Park Middle School Addition**
Jacksonville, Onslow County, North Carolina

Dear Mr. Oliver:

ECS Southeast (ECS) has completed the subsurface exploration and geotechnical engineering analyses for the above-referenced project. Our services were performed in general accordance with our Proposal No. 33:5684-GP, dated March 13, 2023. This report presents our understanding of the geotechnical aspects of the project along with, the results of the field exploration, and our design and construction recommendations.

It has been our pleasure to be of service to Onslow County Schools during the design phase of this project. We would appreciate the opportunity to remain involved during the continuation of the design phase, and we would like to provide our services during construction phase operations to verify the assumptions of subsurface conditions made for this report. Should you have any questions concerning the information contained in this report, and when we can be of further assistance to you, please contact us.

Respectfully submitted,

**ECS Southeast, LLP**

Caitlin M Cerza

***Caitlin M. Cerza***
*Staff Project Manager*
*CCerza@ecslimited.com*

***Winslow Goins, P.E.***
*Principal Engineer*
*WGoins@ecslimited.com*

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## EXECUTIVE SUMMARY

The following summarizes the main findings of the exploration, particularly those that may have a cost impact on the planned development. Further, our principal foundation recommendations are summarized. Information gleaned from the executive summary should not be utilized in lieu of reading the entire geotechnical report.

- The geotechnical exploration performed for the site included twelve (12) standard penetration test (SPT) borings drilled to a depths of approximately 10 to 50 feet and six (6) hand augers with Kessler DCP tests to depths of 4 feet.

- Provided the subgrades are prepared as recommended in this report, the planned structures may be supported by conventional shallow foundations consisting of column or strip footings bearing on compacted Structural Fill and natural soils using a net allowable soil bearing pressure of 2,000 psf.

- Based on the N-values measured in the borings, a Seismic Site Class D designation is appropriate for seismic design of the proposed buildings at this site.

- Groundwater was encountered at depths ranging from approximately 2.5 to 6.0 feet below existing grades at the time of drilling. The observed groundwater levels in the SPT borings may be influenced by the use of drilling fluids.

- Due to the near surface loose SANDS (SM, SP) encountered across to site in the borings, ECS recommends in-place densification with a vibratory roller prior to construction of foundations, pavements, and placement of fill on site.

Please note this Executive Summary is an important part of this report and should be considered a ***"summary"*** only. The subsequent sections of this report constitute our findings, conclusions, and recommendations in their entirety.

# 1.0 INTRODUCTION

## 1.1 GENERAL

The purpose of this study was to provide geotechnical information for the design of foundations, floor slabs, and pavements for the proposed building addition. The project will include the development of a building addition for the proposed gymnasium and classroom expansion and parking lot improvements. The recommendations developed for this report are based on project information supplied by Mr. Dusty Oliver with Onslow County Schools.

Our services were provided in accordance with our Proposal No. 22:27125 dated February 24, 2023, as authorized by purchase order on April 21, 2023.

This report contains the procedures and results of our subsurface exploration programs, review of existing site conditions, engineering analyses, and recommendations for the design and construction of the project.

The report includes the following items.

- A brief review and description of our field test procedures and the results of testing conducted;
- A review of surface topographical features and site conditions;
- A review of subsurface soil stratigraphy with pertinent available physical properties;
- Foundation recommendations;
  - Allowable bearing pressure;
  - Settlement estimates (total and differential);
- Site development recommendations;
- Seismic design considerations;
- Pavement design recommendations;
- Reusability of soils for use as fill material;
- Discussion of groundwater impact;
- Compaction recommendations;
- Site vicinity map;
- Exploration location plan; and
- SPT and hand auger boring logs.

## 2.0 PROJECT INFORMATION

### 2.1 PROJECT LOCATION

The site is located at 904 Sioux Drive in Jacksonville, Onslow County, North Carolina on the Northwoods Park Middle School campus. The site is bounded on all sides by the existing school facilities and residential homes. Figure 2.1.1 below shows an aerial image of the site.


**Figure 2.1.1 Site Location**

### 2.2 CURRENT SITE CONDITIONS

At the time of our exploration, the site consisted of undeveloped and open grass fields with an existing paved parking lot on the east side of the site. Based on our site visit and approximate elevations taken from Google Earth, the site has varying topography with typical site elevations ranging from around 21 to 23 feet.

## 2.3 PROPOSED CONSTRUCTION

The following information explains our understanding and assumptions of the planned development including proposed buildings and related infrastructure:

| SUBJECT | DESIGN INFORMATION / ASSUMPTIONS |
|---|---|
| Usage | Building additions (gymnasium/classrooms and kitchen) and parking lot expansion |
| Building Footprint | Approximately 18,555 square feet for the gymnasium and 792 square feet for the kitchen expansion |
| Finished Floor Elevations | Within +/- 1 foot of existing grades |
| Column Loads | Up to 100 kips |
| Wall Loads | Up to 6 klf |

ECS understands the project consists of construction of a new approximately 18,555 square foot building addition on the north side of the existing middle school that will be used as a gymnasium and contain additional classroom space. A gravel driveway will be constructed around the building addition. The existing kitchen on the east side of the middle school will be expanded by approximately 792 square-feet and additional paved parking and a paved drive aisle will be built on the southwest corner of the site.

## 3.0 FIELD EXPLORATION

Our exploration procedures are explained in greater detail in Appendix B including the Reference Notes for Standard Penetration Testing. Our scope of work included performing twelve (12) SPT borings and six (6) hand augers with Kessler DCP tests. Our approximate boring locations are shown on the Exploration Location Diagram in Appendix A.

### 3.1 SUBSURFACE CHARACTERIZATION

The subsurface conditions encountered were generally consistent with the published geological mapping. The following sections provide generalized characterizations of the soil. Please refer to the SPT boring logs in Appendix B.

The site is located in the Coastal Plain Physiographic Province of North Carolina. The Coastal Plain is composed of seven terraces, each representing a former level of the Atlantic Ocean. Soils in this area generally consist of sedimentary materials transported from other areas by the ocean or rivers. These deposits vary in thickness from a thin veneer along the western edge of the region to more than 10,000 feet near the coast. The sedimentary deposits of the Coastal Plain rest upon consolidated rocks similar to those underlying the Piedmont and Mountain Physiographic Provinces. In general, shallow unconfined groundwater movement within the overlying soils is largely controlled by topographic gradients. Recharge occurs primarily by infiltration along higher elevations and typically discharges into streams or other surface water bodies. The elevation of the shallow water table is transient and can vary greatly with seasonal fluctuations in precipitation.

**Table 3.1.1 SPT Boring Subsurface Stratigraphy**

| Approximate Depth Range (feet) | Stratum | Description | Ranges of N-Values[(1)] blows per foot (bpf) |
|---|---|---|---|
| 0 to (0.25-0.5) (Surface cover) | N/A | Topsoil was encountered on-site with an observed thickness of approximately minimal amounts to 3 inches. Deeper topsoil or organic laden soils are most likely present in wet, poorly drained areas and potentially unexplored areas of the site. Boring B-06 encountered 2 inches of asphalt underlain by 4 inches of ABC Stone. | N/A |
| (0.25-0.5) to 50 | I | Very Loose to Medium Dense SAND (SP, SM, SP-SM), with interbedded firm Sandy CLAY (CL) at B-03. | 0 to 24 |

Notes: (1) Standard Penetration Test Resistances

### 3.2 GROUNDWATER OBSERVATIONS

Water levels were measured in the borings as noted on the soil boring log in Appendix B. Groundwater depths were encountered at the time of drilling approximately 2.5 to 6.0 feet below the ground surface. It should be noted that groundwater readings were influenced by the use of drilling fluids. Variations in the long-term water table may occur as a result of changes in precipitation, evaporation, surface water runoff, construction activities, and other factors.

## 4.0 DESIGN RECOMMENDATIONS

### 4.1 FOUNDATIONS

Provided subgrades and Structural Fills are prepared as recommended in this report and the anticipated column and wall loads provided, in the table in **Section 2.2 Proposed Construction,** are not exceeded, the proposed structures can be supported by shallow foundations including column footings and continuous wall footings. We recommend the foundation design use the following parameters*:*

| Design Parameter | Column Footing | Wall Footing |
|---|---|---|
| Net Allowable Bearing Pressure(1) | 2,000 psf | 2,000 psf |
| Acceptable Bearing Soil Material | Stratum I Soils or Approved Structural Fill | Stratum I Soils or Approved Structural Fill |
| Minimum Width | 30 inches | 18 inches |
| Minimum Footing Embedment Depth (below slab or finished grade) (2) | 18 inches | 18 inches |
| Minimum Exterior Frost Depth (below final exterior grade) | 6 inches | 6 inches |
| Estimated Total Settlement (3) | Less than 1- inch | Less than 1- inch |
| Estimated Differential Settlement (4) | Less than ½ inches between columns | Less than ½ inches |

Notes:

(1) Net allowable bearing pressure is the applied pressure in excess of the surrounding overburden soils above the base of the foundation.
(2) For bearing considerations and frost penetration requirements.
(3) Based on assumed structural loads. If final loads are different, ECS must be contacted to update foundation recommendations and settlement calculations.
(4) Based on maximum column/wall loads and variability in borings. Differential settlement can be re-evaluated once the foundation plans are more complete.

**Potential Undercuts:** A majority of the soils at the estimated foundation bearing elevation are anticipated to be adequate for support of the proposed structure. If soft clays are encountered at the bearing elevation, undercutting may be required. We anticipate in-place densification will be required in the building footprint prior to the construction of the foundations or placement of fill. If soft or loose soils are observed at the footing bearing elevations, the soils should be undercut and removed. Undercut should be backfilled with Structural Fill up to the original design bottom of footing elevation; the original footing may be constructed on top of the Structural Fill.

**4.2 SLABS ON GRADE**

The on-site natural soils are generally considered adequate for support of the slab-on-grade floor slabs. Based on the assumption that the finished floor elevation is around current grades, it appears that the slabs for the structure will likely bear on the Stratum I SANDS (SM, SC) or Structural Fill. The following graphic depicts our soil-supported slab recommendations:

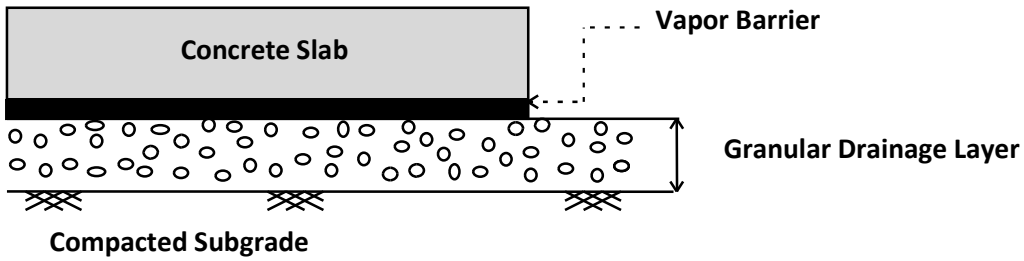



**Figure 4.2.1**

1. Drainage Layer Thickness: 6 inches
2. Drainage Layer Material: GRAVEL (GP) or SAND containing <5% fines passing #200 sieve (SP, SW)

Soft or yielding soils may be encountered in some areas. Those soils should be removed and replaced with compacted Structural Fill in accordance with the recommendations included in this report.

**Subgrade Modulus:** Provided the Structural Fill and Granular Drainage Layer are constructed in accordance with our recommendations, the slab may be designed assuming a modulus of subgrade reaction, $k_1$ of 150 pci (lbs./cu. inch). The modulus of subgrade reaction value is based on a 1 ft by 1 ft plate load test basis.

**Vapor Barrier:** Before the placement of concrete, a vapor barrier may be placed on top of the granular drainage layer to provide additional protection against moisture vapor penetration through the floor slab. Curing of the slab should be performed in accordance with ACI specifications to reduce the potential for uneven drying, curling and/or cracking of the slab. Depending on proposed flooring material types, the structural engineer and/or the architect may choose to do away with the vapor barrier.

**Slab Isolation:** Soil-supported slabs should be isolated from the foundations and foundation-supported elements of the structure so that differential movement between the foundations and slab will not induce excessive shear and bending stresses in the floor slab. Where the structural configuration inhibits the use of a free-floating slab such as in a drop-down footing/monolithic slab configuration, the slab should be designed to avoid overstressing of the slab.

**4.3 SEISMIC SITE CLASSIFICATION**

The 2018 North Carolina Building Code (2015 International Building Code with North Carolina Amendments) requires that a Site Class be assigned for the seismic design of new structures based on the upper 100 feet of a soil profile. At least two methods are utilized in classifying sites, namely the shear wave velocity (vs) method and the Standard Penetration Resistance (N-value) method. The N-value method was used for this project.

| SEISMIC SITE CLASSIFICATION | | | |
|---|---|---|---|
| **Site Class** | **Soil Profile Name** | **Shear Wave Velocity, Vs (ft./s)** | **N value (bpf)** |
| A | Hard Rock | Vs > 5,000 | N/A |
| B | Rock | 2,500 < Vs ≤ 5,000 | N/A |
| C | Very dense soil and soft rock | 1,200 < Vs ≤ 2,500 | >50 |
| **D** | **Stiff Soil Profile** | **600 ≤ Vs ≤ 1,200** | **15 to 50** |
| E | Soft Soil Profile | Vs < 600 | <15 |

Based upon our interpretation of the subsurface conditions, the appropriate Seismic Site Classification is “D” as shown in the preceding table. The Site Class definition should not be confused with the Seismic Design Category designation which the Structural Engineer typically assesses.

Our experience indicates that evaluation of seismic site class in North Carolina using N-values can be overly conservative. If it is evaluated that significant advantage could be gained with an improved Site Class, additional site testing could be performed to measure actual shear wave velocities at the site. ECS can provide a proposal for these services upon request.

**4.4 PAVEMENTS**

**Subgrade Characteristics:** Based on the results of our borings, it appears that the pavement subgrades will consist mainly of Silty SAND (SM) or Structural Fill. In-place densification should be anticipated across the site prior to construction of pavements or placement of Structural Fill due to the near surface very loose to loose sands encountered in the borings. If site earthwork is performed during the typically cooler, wetter months of the year, additional undercutting is anticipated due to excessively wet unstable soils.

California Bearing Ratio (CBR) values were obtained from the Kessler DCP tests performed on site adjacent to the hand auger borings For preliminary design purposes, provided subgrade preparation recommendations and in-place densification recommendations are followed, we recommend assuming a preliminary CBR value of 8.

**Design Considerations:** Anticipated traffic conditions were not provided to ECS. However, based on our experience on similar projects, we assume design traffic loads will include cars, light trucks and school buses, in addition to garbage and heavy trucks. Our recommended pavement sections are based on up to 30,000 ESALs over a 20-year design life for light duty and up to 75,000 ESALs over a 20-year design life for heavy duty. This recommendation does not include construction traffic.

The preliminary pavement sections below are guidelines that may or may not comply with local jurisdictional minimums.

| PROPOSED PAVEMENT SECTIONS | | | | | |
|---|---|---|---|---|---|
| | FLEXIBLE PAVEMENT | | RIGID PAVEMENT | | GRAVEL PAVEMENT |
| MATERIAL | Heavy Duty | Light Duty | Heavy Duty | Light Duty | |
| Portland Cement Concrete (f'c = 4,500 psi) | - | - | 6 in | 6 in | - |
| Asphalt Surface Course | 3 in | 2 in | - | - | - |
| Aggregate Base Course | 8 in | 6 in | 6 in | 4 in | 14 in |

Based on the results of our hand auger borings and Kessler DCP results, the proposed gravel access drive around the gymnasium will be suitable to handle the anticipated emergency traffic loads consisting of 75,000 lb. fire apparatus.

In general, heavy duty sections are areas that will be subjected to trucks, buses, or other similar vehicles including main drive lanes of the development. Light duty sections are appropriate for vehicular traffic and parking areas.

Large, front loading trash dumpsters frequently impose concentrated front wheel loads on pavements during loading. This type of loading typically results in rutting of asphalt pavement and ultimately pavement failures. For preliminary design purposes, we recommend that the pavement in trash pickup areas consist of a 6-inch thick, 4,500 psi, reinforced concrete slab underlain by 4-inches of aggregate base course. When traffic loading becomes available, ECS or the Civil Engineer can design the pavements.

Prior to subbase placement and paving, CBR testing of the subgrade soils (both natural and fill soils) should be performed to evaluate the soil engineering properties for final pavement design. A minimum distance of 18 inches should be maintained between the bottom of the pavement section and the groundwater table.

The soil subgrade should be smooth-rolled and proofrolled prior to ABC placement. Areas that pump, rut, or are otherwise unstable should be re-compacted or undercut and replaced.

To confirm that the specified degree of compaction is being obtained, field compaction testing should be performed in each GAB lift by the geotechnical engineer's representative. We recommend that compaction tests be performed at a minimum frequency of one test per 5,000 square feet per lift in pavement areas.

**Drainage:** An important consideration with the design and construction of pavements is surface and subsurface drainage. Where standing water develops, either on the pavement surface or within the aggregate base course layer, softening of the subgrades and other problems related to the deterioration of the pavement can be expected. This is particularly important at the site due to the moisture sensitive near-surface soils. Furthermore, good drainage should help reduce the possibility of the subgrade materials becoming saturated during the normal service period of the pavement.

# 5.0 SITE CONSTRUCTION RECOMMENDATIONS

## 5.1 SUBGRADE PREPARATION

### 5.1.2 Stripping and Grubbing

The subgrade preparation should consist of stripping vegetation, rootmat, topsoil, existing fill, and any soft or unsuitable materials from the 10-foot expanded building and 5-foot expanded pavement limits. Borings performed in "undisturbed" areas of the site observed approximately 3 inches of topsoil. Deeper topsoil or organic laden soils may be present in wet, low-lying, and poorly drained areas. ECS should be retained to verify that topsoil and unsuitable surficial materials have been removed prior to the placement of Structural Fill or construction of structures.

### 5.1.3 Proofrolling

Prior to fill placement or other construction on subgrades, the subgrades should be evaluated by an ECS field technician. The exposed subgrade should be proofrolled with construction equipment having a minimum axle load of 10 tons [e.g. tandem-axle dump truck loaded to capacity]. Proofrolling should be traversed in two perpendicular directions with overlapping passes of the vehicle under the observation of an ECS technician. This procedure is intended to assist in identifying localized yielding materials.

Where proofrolling identifies areas that are unsteady or "pumping" subgrade those areas should be repaired prior to the placement of subsequent Structural Fill or other construction materials. Methods of stabilization include undercutting and moisture conditioning. The situation should be discussed with ECS to evaluate the appropriate procedure. Test pits may be excavated to explore the shallow subsurface materials to help in evaluating the cause of the observed unsteady materials, and to assist in the evaluation of appropriate remedial actions to stabilize the subgrade.

Due to the near surface loose SANDS (SP, SM) encountered across to site in the borings, ECS recommends in-place densification with a vibratory roller prior to construction of foundations, pavements, and placement of fill on site. Vibratory rolling should not be performed adjacent to existing buildings. If site earthwork is performed during the typically cooler, wetter months of the year, additional undercutting is anticipated due to excessively wet unstable soils.

### 5.1.4 Site Dewatering

**Limited Excavation Dewatering:** Based upon our subsurface exploration at this site, as well as significant experience on sites in nearby areas of similar geologic setting, we believe construction dewatering may be needed in some areas of the site for removing accumulated rainwater and for seepage from the support of excavation (SOE) during installation of foundations, and underground utilities.

Deep wells should not be required for the temporary dewatering system. However, the dewatering operations can be handled by the use of conventional submersible pumps directly in the excavation or temporary trenches.

If temporary sump pits are used, we recommend they be established at an elevation one to two feet below the bottom of the excavation subgrade or bottom of footing. A perforated 55 gallon drum or other temporary structure could be used to house the pump. We recommend continuous dewatering of the excavations using electric pumps or manned gasoline pumps be used during construction.

If dewater operations are performed at the site, ECS recommends that the dewatering operations be performed in accordance with Local, State and Federal Government regulatory requirements for surface water discharges. ECS would be pleased to be consulted by the client on those requirements, if requested.

## 5.2 EARTHWORK OPERATIONS

### 5.2.1 Structural Fill

Prior to placement of Structural Fill, representative bulk samples (about 50 pounds) of on-site and/or off-site borrow should be submitted to ECS for laboratory testing, which will typically include Atterberg limits, natural moisture content, grain-size distribution, and moisture-density relationships (i.e., Proctors) for compaction. Import materials should be tested prior to being hauled to the site to evaluate if they meet project specifications. Alternatively, Proctor data from other accredited laboratories can be submitted if the test results are within the last 90 days.

**Structural Fill Materials:** Materials selected for use as Structural Fill should consist of inorganic soils with the following engineering properties and compaction requirements.

| STRUCTURAL FILL INDEX PROPERTIES | |
|---|---|
| **Subject** | **Property** |
| Building and Pavement Areas | LL < 40, PI<10 |
| Max. Particle Size | 3 inches |
| Fines Content | Max. 20 % < #200 sieve |
| Max. organic content | 5% by dry weight |

| STRUCTURAL FILL COMPACTION REQUIREMENTS | |
|---|---|
| **Subject** | **Requirement** |
| Compaction Standard | Standard Proctor, ASTM D698 |
| Required Compaction | 98% of Max. Dry Density |
| Dry Unit Weight | >100 pcf |
| Moisture Content | -2 to +2 % points of the soil's optimum value |
| Loose Thickness | 8 inches prior to compaction |

**On-Site Borrow Suitability:** Natural deposits of fill material are not present on the site. The on-site sands (SP, SM, SP-SM) across the site with fines contents less than 20 percent should meet the recommendations for re-use as Structural Fill.

**Fill Placement:** Fill materials should not be placed on frozen soils, on frost-heaved soils, and/or on excessively wet soils. Borrow fill materials should not contain frozen materials at the time of placement, and frozen or frost-heaved soils should be removed prior to placement of Structural Fill or other fill soils and aggregates. Excessively wet soils or aggregates should be scarified, aerated, and moisture conditioned.

### 5.3 FOUNDATION AND SLAB OBSERVATIONS

**Protection of Foundation Excavations:** Exposure to the environment may weaken the soils at the footing bearing level if the foundation excavations remain open for too long a time. Therefore, foundation concrete should be placed the same day that excavations are made. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be removed from the foundation excavation bottom immediately prior to placement of concrete. If the excavation must remain open overnight, or if rainfall becomes imminent while the bearing soils are exposed, a 1 to 3-inch thick "mud mat" of "lean" concrete should be placed on the bearing soils before the placement of reinforcing steel.

**Footing Subgrade Observations:** A majority of the soils encountered on site at the foundation bearing elevation are anticipated to be adequate for support of the proposed structure. It is important to have ECS observe the foundation subgrade prior to placing foundation concrete, to confirm the bearing soils are what was anticipated.

**Slab Subgrade Verification:** Prior to placement of a drainage layer, the subgrade should be prepared in accordance with the recommendations found in **Section 5.1.2 Proofrolling**.

### 5.4 UTILITY INSTALLATIONS

**Utility Subgrades:** The soils encountered in our exploration are expected to be generally adequate for support of utility pipes. The pipe subgrades should be observed and probed for stability by ECS. Loose or unsteady materials encountered should be removed and replaced with compacted Structural Fill, or pipe stone bedding material.

**Utility Backfilling:** The granular bedding material (AASHTO #57 stone) should be 4 inches thick, but not less than that specified by the civil engineer's project drawings and specifications. We recommend that the bedding materials be placed up to the springline of the pipe. Fill placed for support of the utilities, as well as backfill over the utilities, should meet the requirements for Structural Fill and fill placement.

**Excavation Safety:** Excavations and slopes should be constructed and maintained in accordance with OSHA excavation safety standards. The contractor is solely responsible for designing, constructing, and maintaining steady temporary excavations and slopes. The contractor's responsible person, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. The slope height, slope inclination, or excavation depth, including utility trench excavation depth, should not exceed those specified in local, state, and federal safety regulations. ECS is providing this information solely as a service to our client. ECS is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

## 6.0 CLOSING

ECS has prepared this report to guide the geotechnical-related design and construction aspects of the project. We performed these services in accordance with the standard of care expected of professionals in the industry performing similar services on projects of like size and complexity at this time in the region. No other representation expressed or implied, and no warranty or guarantee is included or intended in this report.

The description of the proposed project is based on the limited information provided to ECS by Mr. Dusty Johnson with Onslow County Schools. If any of this information is inaccurate, either due to our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted immediately so that we can review the report in light of the changes and provide additional or alternate recommendations as may be required.

We recommend that ECS be allowed to review the project's plans and specifications pertaining to our work so that we may ascertain consistency of those plans/specifications with the intent of the geotechnical report.

Field observations and quality assurance testing during earthwork and foundation installation are an extension of, and integral to, the geotechnical design. We recommend that ECS be retained to apply our expertise throughout the geotechnical phases of construction, and to provide consultation and recommendation should issues arise.

ECS is not responsible for the conclusions, opinions, or recommendations of others based on the data in this report.

## APPENDIX A – Drawings

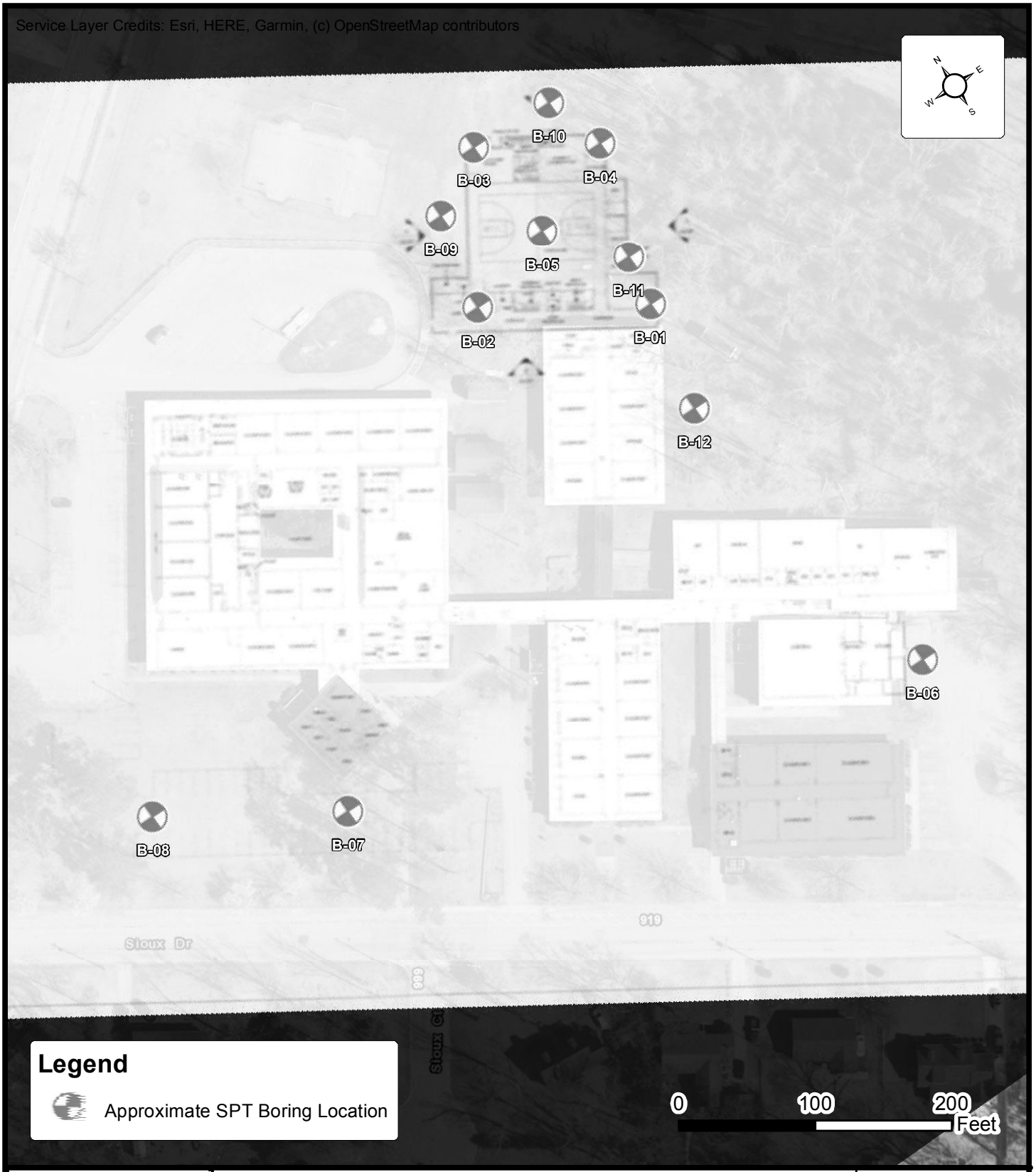
Site Location Diagram
Boring Location Diagram


# SITE LOCATION DIAGRAM
# NORTHWOODS PARK MIDDLE SCHOOL

**904 SIOUX DR, JACKSONVILLLE, NC**

**ONSLOW COUNTY SCHOOLS**

| | |
|---|---|
| ENGINEER | WEG |
| SCALE | AS NOTED |
| PROJECT NO. | 22:33137 |
| FIGURE | 1 OF 2 |
| DATE | 5/22/2023 |




# BORING LOCATION DIAGRAM
# NORTHWOODS PARK MIDDLE SCHOOL

**904 SIOUX DR, JACKSONVILLLE, NC**

**ONSLOW COUNTY SCHOOLS**

| | |
|---|---|
| ENGINEER | WEG |
| SCALE | AS NOTED |
| PROJECT NO. | 22:33137 |
| FIGURE | 2 OF 2 |
| DATE | 5/2/2023 |

## APPENDIX B – Field Operations

Reference Notes for Boring Logs
SPT Boring Log (B-01 through B-12)
Hand Auger Boring Logs (K-07 through K-12)
Kessler Dynamic Cone Penetrometer (DCP) Test Results (K-07 through K-12)

# REFERENCE NOTES FOR BORING LOGS

## MATERIAL[1,2]

| | |
|---|---|
| | **ASPHALT** |
| | **CONCRETE** |
| | **GRAVEL** |
| | **TOPSOIL** |
| | **VOID** |
| | **BRICK** |
| | **AGGREGATE BASE COURSE** |
| | **GW WELL-GRADED GRAVEL** gravel-sand mixtures, little or no fines |
| | **GP POORLY-GRADED GRAVEL** gravel-sand mixtures, little or no fines |
| | **GM SILTY GRAVEL** gravel-sand-silt mixtures |
| | **GC CLAYEY GRAVEL** gravel-sand-clay mixtures |
| | **SW WELL-GRADED SAND** gravelly sand, little or no fines |
| | **SP POORLY-GRADED SAND** gravelly sand, little or no fines |
| | **SM SILTY SAND** sand-silt mixtures |
| | **SC CLAYEY SAND** sand-clay mixtures |
| | **ML SILT** non-plastic to medium plasticity |
| | **MH ELASTIC SILT** high plasticity |
| | **CL LEAN CLAY** low to medium plasticity |
| | **CH FAT CLAY** high plasticity |
| | **OL ORGANIC SILT or CLAY** non-plastic to low plasticity |
| | **OH ORGANIC SILT or CLAY** high plasticity |
| | **PT PEAT** highly organic soils |

## DRILLING SAMPLING SYMBOLS & ABBREVIATIONS

| | | | |
|---|---|---|---|
| SS | Split Spoon Sampler | PM | Pressuremeter Test |
| ST | Shelby Tube Sampler | RD | Rock Bit Drilling |
| WS | Wash Sample | RC | Rock Core, NX, BX, AX |
| BS | Bulk Sample of Cuttings | REC | Rock Sample Recovery % |
| PA | Power Auger (no sample) | RQD | Rock Quality Designation % |
| HSA | Hollow Stem Auger | | |

## PARTICLE SIZE IDENTIFICATION

| DESIGNATION | | PARTICLE SIZES |
|---|---|---|
| Boulders | | 12 inches (300 mm) or larger |
| Cobbles | | 3 inches to 12 inches (75 mm to 300 mm) |
| Gravel: | Coarse | ¾ inch to 3 inches (19 mm to 75 mm) |
| | Fine | 4.75 mm to 19 mm (No. 4 sieve to ¾ inch) |
| Sand: | Coarse | 2.00 mm to 4.75 mm (No. 10 to No. 4 sieve) |
| | Medium | 0.425 mm to 2.00 mm (No. 40 to No. 10 sieve) |
| | Fine | 0.074 mm to 0.425 mm (No. 200 to No. 40 sieve) |
| Silt & Clay ("Fines") | | <0.074 mm (smaller than a No. 200 sieve) |

## COHESIVE SILTS & CLAYS

| UNCONFINED COMPRESSIVE STRENGTH, $Q_P$[4] | SPT[5] (BPF) | CONSISTENCY[7] (COHESIVE) |
|---|---|---|
| <0.25 | <2 | Very Soft |
| 0.25 - <0.50 | 2 - 4 | Soft |
| 0.50 - <1.00 | 5 - 8 | Firm |
| 1.00 - <2.00 | 9 - 15 | Stiff |
| 2.00 - <4.00 | 16 - 30 | Very Stiff |
| 4.00 - 8.00 | 31 - 50 | Hard |
| >8.00 | >50 | Very Hard |

## GRAVELS, SANDS & NON-COHESIVE SILTS

| SPT[5] | DENSITY |
|---|---|
| <5 | Very Loose |
| 5 - 10 | Loose |
| 11 - 30 | Medium Dense |
| 31 - 50 | Dense |
| >50 | Very Dense |

| RELATIVE AMOUNT[7] | COARSE GRAINED (%)[8] | FINE GRAINED (%)[8] |
|---|---|---|
| Trace | ≤5 | ≤5 |
| With | 10 - 20 | 10 - 25 |
| Adjective *(ex: "Silty")* | 25 - 45 | 30 - 45 |

## WATER LEVELS[6]

- WL (First Encountered)
- WL (Completion)
- WL (Seasonal High Water)
- WL (Stabilized)

## FILL AND ROCK

FILL | POSSIBLE FILL | PROBABLE FILL | ROCK

[1]Classifications and symbols per ASTM D 2488-17 (Visual-Manual Procedure) unless noted otherwise.

[2]To be consistent with general practice, "POORLY GRADED" has been removed from GP, GP-GM, GP-GC, SP, SP-SM, SP-SC soil types on the boring logs.

[3]Non-ASTM designations are included in soil descriptions and symbols along with ASTM symbol [Ex: (SM-FILL)].

[4]Typically estimated via pocket penetrometer or Torvane shear test and expressed in tons per square foot (tsf).

[5]Standard Penetration Test (SPT) refers to the number of hammer blows (blow count) of a 140 lb. hammer falling 30 inches on a 2 inch OD split spoon sampler required to drive the sampler 12 inches (ASTM D 1586). "N-value" is another term for "blow count" and is expressed in blows per foot (bpf). SPT correlations per 7.4.2 Method B and need to be corrected if using an auto hammer.

[6]The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in granular soils. In clay and cohesive silts, the determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally employed.

[7]Minor deviation from ASTM D 2488-17 Note 14.

[8]Percentages are estimated to the nearest 5% per ASTM D 2488-17.

| CLIENT: | PROJECT NO.: | BORING NO.: | SHEET: |
|---|---|---|---|
| **Onslow County Schools** | **22:33137** | **B-01** | **1 of 1** |
| PROJECT NAME: | DRILLER/CONTRACTOR: | | |
| **Northwoods Park Middle School Addition - PO#20232598** | **Miller Drilling Company** | | |
| SITE LOCATION: | | | LOSS OF CIRCULATION |
| **904 Sioux Dr, Jacksonvillle, North Carolina, 28540** | | | |
| NORTHING: | EASTING: | STATION: | SURFACE ELEVATION: / BOTTOM OF CASING |

| DEPTH (FT) | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE DIST. (IN) | RECOVERY (IN) | DESCRIPTION OF MATERIAL | WATER LEVELS | ELEVATION (FT) | BLOWS/6" | STANDARD PENETRATION BLOWS/FT (20 40 60 80 100) / ROCK QUALITY DESIGNATION & RECOVERY (RQD, REC) | LIQUID LIMIT / PLASTIC LIMIT / CALIBRATED PENETROMETER TSF (1 2 3 4 5) / WATER CONTENT % [FINES CONTENT] % (10 20 30 40 50) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Topsoil Thickness[3.00"] | | | | | |
| | S-1 | SS | 18 | 18 | (SM) SILTY FINE SAND, brown, moist to saturated, very loose | | | 2-2-2 (4) | 4 | |
| | S-2 | SS | 18 | 18 | (SP) FINE SAND, brown, saturated, very loose to loose | | -5 | 3-2-1 (3) | 3 | |
| 5 | S-3 | SS | 18 | 18 | | | | 1-1-1 (2) | 2 | |
| | S-4 | SS | 18 | 18 | | | -10 | 3-3-3 (6) | 6 | |
| 10 | | | | | (SP-SM) FINE SAND WITH SILT, gray, saturated, medium dense to loose | | | | | |
| | S-5 | SS | 18 | 18 | | | -15 | 4-5-6 (11) | 11 | |
| 15 | | | | | | | | | | |
| | S-6 | SS | 18 | 18 | | | -20 | 3-4-4 (8) | 8 | |
| 20 | | | | | | | | | | |
| | S-7 | SS | 18 | 18 | | | -25 | 4-5-7 (12) | 12 | |
| 25 | | | | | | | | | | |
| | S-8 | SS | 18 | 18 | | | | 4-4-6 (10) | 10 | |
| 30 | | | | | **END OF BORING AT 30 FT** | | | | | |

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

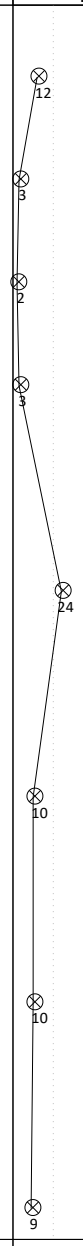
| | | | |
|---|---|---|---|
| ▽ WL (First Encountered) | BORING STARTED: **May 08 2023** | | CAVE IN DEPTH: |
| ▼ WL (Completion) **3.00** | BORING COMPLETED: **May 08 2023** | | HAMMER TYPE: **Auto** |
| ⧩ WL (Seasonal High Water) | EQUIPMENT: **Track** | LOGGED BY: **OMA** | DRILLING METHOD: |
| ⧨ WL (Stabilized) | | | |

**GEOTECHNICAL BOREHOLE LOG**

| CLIENT: | PROJECT NO.: | BORING NO.: | SHEET: |
|---|---|---|---|
| **Onslow County Schools** | **22:33137** | **B-02** | **1 of 1** |
| PROJECT NAME: | DRILLER/CONTRACTOR: | | |
| **Northwoods Park Middle School Addition - PO#20232598** | **Mid Atlantic Drilling, Inc.** | | |
| SITE LOCATION: | | | LOSS OF CIRCULATION |
| **904 Sioux Dr, Jacksonvillle, North Carolina, 28540** | | | |
| NORTHING: | EASTING: | STATION: | SURFACE ELEVATION: / BOTTOM OF CASING |

| DEPTH (FT) | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE DIST. (IN) | RECOVERY (IN) | DESCRIPTION OF MATERIAL | WATER LEVELS | ELEVATION (FT) | BLOWS/6" |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | (SM) SILTY FINE SAND, brown, moist to saturated, medium dense to very loose | | 0 | |
| | S-1 | SS | 18 | 18 | | | | 7-8-4 (12) |
| | S-2 | SS | 18 | 18 | | | | 1-2-1 (3) |
| 5 | | | | | (SP) FINE SAND, tan, saturated, very loose | | -5 | |
| | S-3 | SS | 18 | 18 | | | | 1-1-1 (2) |
| | S-4 | SS | 18 | 18 | (SP-SM) FINE SAND WITH SILT, gray, saturated, very loose to medium dense | | | 1-2-1 (3) |
| 10 | | | | | | | -10 | |
| | S-5 | SS | 18 | 18 | | | | 18-16-8 (24) |
| 15 | | | | | | | -15 | |
| | S-6 | SS | 18 | 18 | | | | 4-4-6 (10) |
| 20 | | | | | | | -20 | |
| | S-7 | SS | 18 | 18 | | | | 4-4-6 (10) |
| 25 | | | | | | | -25 | |
| | S-8 | SS | 18 | 18 | | | | 4-4-5 (9) |
| 30 | | | | | **END OF BORING AT 30 FT** | | | |

STANDARD PENETRATION BLOWS/FT (20 40 60 80 100)
ROCK QUALITY DESIGNATION & RECOVERY — RQD — REC
LIQUID LIMIT △ PLASTIC LIMIT ×
CALIBRATED PENETROMETER TSF (1 2 3 4 5)
WATER CONTENT % ● [FINES CONTENT] % (10 20 30 40 50)




THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| ▽ WL (First Encountered) | | BORING STARTED: **May 08 2023** | CAVE IN DEPTH: |
| ▼ WL (Completion) | **3.50** | BORING COMPLETED: **May 08 2023** | HAMMER TYPE: **Auto** |
| ▼ WL (Seasonal High Water) | | EQUIPMENT: **Track** / LOGGED BY: **OMA** | DRILLING METHOD: **Mud rotary** |
| ▽ WL (Stabilized) | | | |

**GEOTECHNICAL BOREHOLE LOG**

| CLIENT: | PROJECT NO.: | BORING NO.: | SHEET: |
|---|---|---|---|
| **Onslow County Schools** | **22:33137** | **B-03** | **1 of 1** |
| PROJECT NAME: | DRILLER/CONTRACTOR: | | |
| **Northwoods Park Middle School Addition - PO#20232598** | **Mid Atlantic Drilling, Inc.** | | |
| SITE LOCATION: | | | LOSS OF CIRCULATION |
| **904 Sioux Dr, Jacksonvillle, North Carolina, 28540** | | | |
| NORTHING: | EASTING: | STATION: | SURFACE ELEVATION: / BOTTOM OF CASING |

| DEPTH (FT) | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE DIST. (IN) | RECOVERY (IN) | DESCRIPTION OF MATERIAL | WATER LEVELS | ELEVATION (FT) | BLOWS/6" |
|---|---|---|---|---|---|---|---|---|
| | | | | | Topsoil Thickness[3.00"] | | | |
| | S-1 | SS | 18 | 18 | (SM) SILTY FINE SAND, brown, moist to saturated, very loose | ▼ | | 1-1-2 (3) |
| | S-2 | SS | 18 | 18 | | | | 1-2-2 (4) |
| 5 | | | | | | | -5 | |
| | S-3 | SS | 18 | 18 | (CL) SANDY LEAN CLAY, gray, saturated, firm | | | WOH-3-5 (8) |
| | S-4 | SS | 18 | 18 | (SP-SM) FINE SAND WITH SILT, gray, saturated, loose | | | 2-2-3 (5) |
| 10 | | | | | | | -10 | |
| | S-5 | SS | 18 | 18 | (SP-SM) FINE SAND WITH SILT, gray, saturated, loose to medium dense, with weathered limestone | | | 3-4-5 (9) |
| 15 | | | | | | | -15 | |
| | S-6 | SS | 18 | 18 | | | | 3-4-7 (11) |
| 20 | | | | | | | -20 | |
| | S-7 | SS | 18 | 18 | | | | 3-5-7 (12) |
| 25 | | | | | | | -25 | |
| | S-8 | SS | 18 | 18 | (SP-SM) FINE SAND WITH SILT, gray, saturated, loose | | | 3-4-5 (9) |
| 30 | | | | | **END OF BORING AT 30 FT** | | | |

STANDARD PENETRATION BLOWS/FT (20 40 60 80 100)
ROCK QUALITY DESIGNATION & RECOVERY — RQD — REC
LIQUID LIMIT △ PLASTIC LIMIT ×
CALIBRATED PENETROMETER TSF (1 2 3 4 5)
WATER CONTENT % ● [FINES CONTENT] % (10 20 30 40 50)

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| ▽ WL (First Encountered) | BORING STARTED: **May 08 2023** | | CAVE IN DEPTH: |
| ▼ WL (Completion) **2.50** | BORING COMPLETED: **May 08 2023** | | HAMMER TYPE: **Auto** |
| ⧩ WL (Seasonal High Water) | EQUIPMENT: **Track** | LOGGED BY: **OMA** | DRILLING METHOD: **Mud rotary** |
| ⧨ WL (Stabilized) | | | |

**GEOTECHNICAL BOREHOLE LOG**

| CLIENT: | PROJECT NO.: | BORING NO.: | SHEET: |
|---|---|---|---|
| **Onslow County Schools** | **22:33137** | **B-04** | **1 of 1** |
| PROJECT NAME: | DRILLER/CONTRACTOR: | | |
| **Northwoods Park Middle School Addition - PO#20232598** | **Mid Atlantic Drilling, Inc.** | | |
| SITE LOCATION: | | | LOSS OF CIRCULATION |
| **904 Sioux Dr, Jacksonvillle, North Carolina, 28540** | | | |
| NORTHING: | EASTING: | STATION: | SURFACE ELEVATION: / BOTTOM OF CASING |

| DEPTH (FT) | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE DIST. (IN) | RECOVERY (IN) | DESCRIPTION OF MATERIAL | ELEVATION (FT) | BLOWS/6" |
|---|---|---|---|---|---|---|---|
| 0 | | | | | Topsoil Thickness[3.00"] | | |
| | S-1 | SS | 18 | 18 | (SM) SILTY FINE SAND, brown, moist to saturated, very loose to medium dense | | 2-1-1 (2) |
| | S-2 | SS | 18 | 18 | | | 3-3-4 (7) |
| 5 | S-3 | SS | 18 | 18 | | -5 | 4-8-7 (15) |
| | S-4 | SS | 18 | 18 | (SP-SM) FINE SAND WITH SILT, gray, saturated, medium dense | -10 | 6-7-4 (11) |
| 10 | | | | | | | |
| | S-5 | SS | 18 | 18 | | -15 | 3-6-7 (13) |
| 15 | | | | | | | |
| | S-6 | SS | 18 | 18 | | -20 | 4-5-6 (11) |
| 20 | | | | | | | |
| | S-7 | SS | 18 | 18 | | -25 | 3-11-13 (24) |
| 25 | | | | | | | |
| | S-8 | SS | 18 | 18 | | | 4-11-13 (24) |
| 30 | | | | | **END OF BORING AT 30 FT** | | |

STANDARD PENETRATION BLOWS/FT (20 40 60 80 100)
ROCK QUALITY DESIGNATION & RECOVERY — RQD — REC
LIQUID LIMIT
PLASTIC LIMIT
CALIBRATED PENETROMETER TSF (1 2 3 4 5)
WATER CONTENT % [FINES CONTENT] % (10 20 30 40 50)

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL (First Encountered) | | BORING STARTED: **May 08 2023** | CAVE IN DEPTH: |
| WL (Completion) | **3.50** | BORING COMPLETED: **May 08 2023** | HAMMER TYPE: **Auto** |
| WL (Seasonal High Water) | | EQUIPMENT: **Track** / LOGGED BY: **OMA** | DRILLING METHOD: **Mud rotary** |
| WL (Stabilized) | | | |

**GEOTECHNICAL BOREHOLE LOG**

| CLIENT: | PROJECT NO.: | BORING NO.: | SHEET: |
|---|---|---|---|
| **Onslow County Schools** | **22:33137** | **B-05** | **1 of 2** |
| PROJECT NAME: | DRILLER/CONTRACTOR: | | |
| **Northwoods Park Middle School Addition - PO#20232598** | **Mid Atlantic Drilling, Inc.** | | |
| SITE LOCATION: | | | LOSS OF CIRCULATION |
| **904 Sioux Dr, Jacksonvillle, North Carolina, 28540** | | | |
| NORTHING: | EASTING: | STATION: | SURFACE ELEVATION: / BOTTOM OF CASING |

| DEPTH (FT) | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE DIST. (IN) | RECOVERY (IN) | DESCRIPTION OF MATERIAL | WATER LEVELS | ELEVATION (FT) | BLOWS/6" |
|---|---|---|---|---|---|---|---|---|
| | | | | | Topsoil Thickness[3.00"] | | | |
| | S-1 | SS | 18 | 18 | (SM) SILTY FINE SAND, brown, moist to saturated, loose to very loose | ▼ | | 1-2-5 (7) |
| | S-2 | SS | 18 | 18 | | | | 2-1-3 (4) |
| 5 | S-3 | SS | 18 | 18 | (SP) FINE SAND, tan, saturated, loose | | -5 | 3-3-2 (5) |
| | S-4 | SS | 18 | 18 | (SP-SM) FINE SAND WITH SILT, gray, saturated, loose | | | 2-2-3 (5) |
| 10 | | | | | | | -10 | |
| | S-5 | SS | 18 | 18 | (SP-SM) FINE SAND WITH SILT, gray, saturated, medium dense, with weathered limestone | | | 6-5-8 (13) |
| 15 | | | | | | | -15 | |
| | S-6 | SS | 18 | 18 | (SP-SM) FINE SAND WITH SILT, gray, saturated, loose to medium dense | | | 4-4-5 (9) |
| 20 | | | | | | | -20 | |
| | S-7 | SS | 18 | 18 | | | | 1-6-4 (10) |
| 25 | | | | | | | -25 | |
| | S-8 | SS | 18 | 18 | | | | 4-4-4 (8) |
| 30 | | | | | **CONTINUED ON NEXT PAGE** | | | |

STANDARD PENETRATION BLOWS/FT (20 40 60 80 100)
ROCK QUALITY DESIGNATION & RECOVERY — RQD — REC

△ LIQUID LIMIT
× PLASTIC LIMIT
○ CALIBRATED PENETROMETER TSF (1 2 3 4 5)
● WATER CONTENT % [FINES CONTENT] % (10 20 30 40 50)

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| ▽ WL (First Encountered) | BORING STARTED: **May 08 2023** | | CAVE IN DEPTH: |
| ▼ WL (Completion) **3.00** | BORING COMPLETED: **May 08 2023** | | HAMMER TYPE: **Auto** |
| ⧩ WL (Seasonal High Water) | EQUIPMENT: **Track** | LOGGED BY: **OMA** | DRILLING METHOD: **Mud rotary** |
| ▽ WL (Stabilized) | | | |

**GEOTECHNICAL BOREHOLE LOG**

| CLIENT: | PROJECT NO.: | BORING NO.: | SHEET: |
|---|---|---|---|
| **Onslow County Schools** | **22:33137** | **B-05** | **2 of 2** |
| PROJECT NAME: | DRILLER/CONTRACTOR: | | |
| **Northwoods Park Middle School Addition - PO#20232598** | **Mid Atlantic Drilling, Inc.** | | |
| SITE LOCATION: | | | LOSS OF CIRCULATION |
| **904 Sioux Dr, Jacksonvillle, North Carolina, 28540** | | | |
| NORTHING: | EASTING: | STATION: | SURFACE ELEVATION: / BOTTOM OF CASING |

| DEPTH (FT) | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE DIST. (IN) | RECOVERY (IN) | DESCRIPTION OF MATERIAL | WATER LEVELS | ELEVATION (FT) | BLOWS/6" |
|---|---|---|---|---|---|---|---|---|
| 35 | S-9 | SS | 18 | 18 | (SP-SM) FINE SAND WITH SILT, gray, saturated, loose to medium dense | | -35 | 5-5-6 (11) |
| 40 | S-10 | SS | 18 | 18 | | | -40 | 5-5-6 (11) |
| 45 | S-11 | SS | 18 | 18 | | | -45 | 6-7-10 (17) |
| 50 | S-12 | SS | 18 | 18 | **END OF BORING AT 50 FT** | | -50 | 4-5-6 (11) |
| 55 | | | | | | | -55 | |
| 60 | | | | | | | | |

STANDARD PENETRATION BLOWS/FT (20 40 60 80 100)
ROCK QUALITY DESIGNATION & RECOVERY — RQD — REC
LIQUID LIMIT
PLASTIC LIMIT
CALIBRATED PENETROMETER TSF (1 2 3 4 5)
WATER CONTENT % [FINES CONTENT] % (10 20 30 40 50)

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| ▽ WL (First Encountered) | BORING STARTED: **May 08 2023** | | CAVE IN DEPTH: |
| ▼ WL (Completion) **3.00** | BORING COMPLETED: **May 08 2023** | | HAMMER TYPE: **Auto** |
| ⧩ WL (Seasonal High Water) | EQUIPMENT: **Track** | LOGGED BY: **OMA** | DRILLING METHOD: **Mud rotary** |
| ⧨ WL (Stabilized) | | | |

**GEOTECHNICAL BOREHOLE LOG**

| CLIENT: | PROJECT NO.: | BORING NO.: | SHEET: |
|---|---|---|---|
| **Onslow County Schools** | **22:33137** | **B-06** | **1 of 1** |

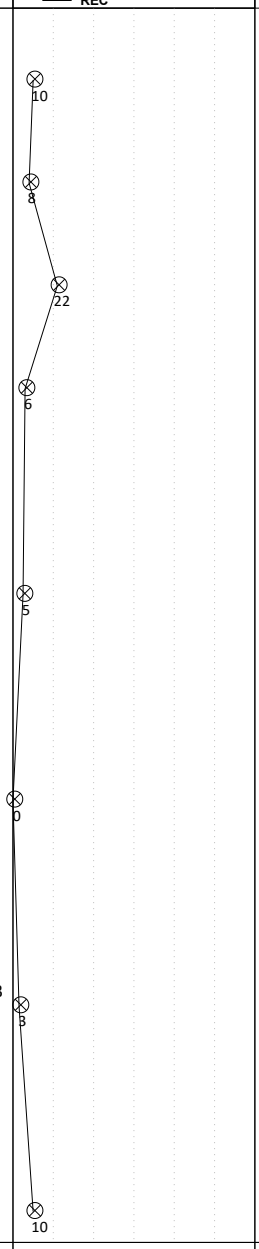
| PROJECT NAME: | DRILLER/CONTRACTOR: |
|---|---|
| **Northwoods Park Middle School Addition - PO#20232598** | **Mid Atlantic Drilling, Inc.** |

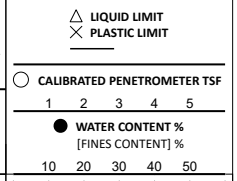
SITE LOCATION: **904 Sioux Dr, Jacksonvillle, North Carolina, 28540**

LOSS OF CIRCULATION

| NORTHING: | EASTING: | STATION: | SURFACE ELEVATION: | BOTTOM OF CASING |
|---|---|---|---|---|
| | | | | |

| DEPTH (FT) | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE DIST. (IN) | RECOVERY (IN) | DESCRIPTION OF MATERIAL | WATER LEVELS | ELEVATION (FT) | BLOWS/6" |
|---|---|---|---|---|---|---|---|---|
| | | | | | Asphalt Thickness[2.00"] | | | |
| | | | | | ABC Stone Thickness[4.00"] | | | |
| | S-1 | SS | 18 | 18 | (SM) SILTY FINE SAND, brown, moist, loose | | | 7-5-5 (10) |
| | S-2 | SS | 18 | 18 | (SP-SM) FINE SAND WITH SILT, gray/ brown, moist, loose | | | 4-4-4 (8) |
| 5 | S-3 | SS | 18 | 18 | (SP) FINE SAND, tan, moist to saturated, medium dense to loose | ▼ | -5 | 7-10-12 (22) |
| | S-4 | SS | 18 | 18 | | | | 3-3-3 (6) |
| 10 | | | | | | | -10 | |
| | S-5 | SS | 18 | 18 | (SP-SM) FINE SAND WITH SILT, gray/ tan, saturated, loose | | | 2-3-2 (5) |
| 15 | | | | | | | -15 | |
| | S-6 | SS | 18 | 18 | (SM) SILTY FINE SAND, gray, saturated, very loose to loose | | | WOH-WOH-WOH (0) |
| 20 | | | | | | | -20 | |
| | S-7 | SS | 18 | 18 | | | | WOH-WOH-3 (3) |
| 25 | | | | | | | -25 | |
| | S-8 | SS | 18 | 18 | | | | 3-4-6 (10) |
| 30 | | | | | **END OF BORING AT 30 FT** | | | |




THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| ▽ WL (First Encountered) | | BORING STARTED: **May 11 2023** | CAVE IN DEPTH: |
| ▼ WL (Completion) | **6.00** | BORING COMPLETED: **May 11 2023** | HAMMER TYPE: **Auto** |
| ▼ WL (Seasonal High Water) | | EQUIPMENT: **Track** / LOGGED BY: **OMA** | DRILLING METHOD: **Mud rotary** |
| ▽ WL (Stabilized) | | | |

## GEOTECHNICAL BOREHOLE LOG

| CLIENT: | PROJECT NO.: | BORING NO.: | SHEET: |
|---|---|---|---|
| **Onslow County Schools** | **22:33137** | **B-07** | **1 of 1** |
| PROJECT NAME: | DRILLER/CONTRACTOR: | | |
| **Northwoods Park Middle School Addition - PO#20232598** | **Mid Atlantic Drilling, Inc.** | | |
| SITE LOCATION: | | | LOSS OF CIRCULATION |
| **904 Sioux Dr, Jacksonvillle, North Carolina, 28540** | | | |
| NORTHING: | EASTING: | STATION: | SURFACE ELEVATION: / BOTTOM OF CASING |

| DEPTH (FT) | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE DIST. (IN) | RECOVERY (IN) | DESCRIPTION OF MATERIAL | WATER LEVELS | ELEVATION (FT) | BLOWS/6" |
|---|---|---|---|---|---|---|---|---|
| | | | | | Topsoil Thickness[3.00"] | | | |
| | S-1 | SS | 18 | 18 | (SM) SILTY FINE SAND, brown, moist to saturated, very loose to loose | | | 2-1-2 (3) |
| | S-2 | SS | 18 | 18 | | ▼ | | 2-2-3 (5) |
| 5 | | | | | | | -5 | |
| | S-3 | SS | 18 | 18 | (SP-SM) FINE SAND WITH SILT, brown to gray, saturated, loose to very loose | | | 4-5-5 (10) |
| | S-4 | SS | 18 | 18 | | | | 2-1-2 (3) |
| 10 | | | | | **END OF BORING AT 10 FT** | | -10 | |
| 15 | | | | | | | -15 | |
| 20 | | | | | | | -20 | |
| 25 | | | | | | | -25 | |
| 30 | | | | | | | | |

STANDARD PENETRATION BLOWS/FT: 20 40 60 80 100
ROCK QUALITY DESIGNATION & RECOVERY — RQD — REC
LIQUID LIMIT △ PLASTIC LIMIT ×
CALIBRATED PENETROMETER TSF: 1 2 3 4 5
WATER CONTENT % ● [FINES CONTENT] %: 10 20 30 40 50


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| ▽ WL (First Encountered) | | BORING STARTED: **May 09 2023** | CAVE IN DEPTH: |
| ▼ WL (Completion) | **4.00** | BORING COMPLETED: **May 09 2023** | HAMMER TYPE: **Auto** |
| ▼ WL (Seasonal High Water) | | EQUIPMENT: **Track** / LOGGED BY: **OMA** | DRILLING METHOD: **Mud rotary** |
| ▽ WL (Stabilized) | | | |

**GEOTECHNICAL BOREHOLE LOG**

| CLIENT: | PROJECT NO.: | BORING NO.: | SHEET: |
|---|---|---|---|
| **Onslow County Schools** | **22:33137** | **B-8** | **1 of 1** |
| PROJECT NAME: | DRILLER/CONTRACTOR: | | |
| **Northwoods Park Middle School Addition - PO#20232598** | **Mid Atlantic Drilling, Inc.** | | |
| SITE LOCATION: | | | LOSS OF CIRCULATION |
| **904 Sioux Dr, Jacksonvillle, North Carolina, 28540** | | | |
| NORTHING: | EASTING: | STATION: | SURFACE ELEVATION: / BOTTOM OF CASING |

| DEPTH (FT) | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE DIST. (IN) | RECOVERY (IN) | DESCRIPTION OF MATERIAL | WATER LEVELS | ELEVATION (FT) | BLOWS/6" |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | Topsoil Thickness[3.00"] | | | |
| | S-1 | SS | 18 | 18 | (SM) SILTY FINE SAND, brown, moist to saturated, very loose to medium dense | ▼ | | 2-2-1 (3) |
| | S-2 | SS | 18 | 18 | | | | 5-7-7 (14) |
| 5 | | | | | | | -5 | |
| | S-3 | SS | 18 | 18 | (SP-SM) FINE SAND WITH SILT, gray, saturated, very loose | | | 1-1-1 (2) |
| | S-4 | SS | 18 | 18 | | | | 2-2-1 (3) |
| 10 | | | | | **END OF BORING AT 10 FT** | | -10 | |
| 15 | | | | | | | -15 | |
| 20 | | | | | | | -20 | |
| 25 | | | | | | | -25 | |
| 30 | | | | | | | | |

STANDARD PENETRATION BLOWS/FT (20 40 60 80 100)
ROCK QUALITY DESIGNATION & RECOVERY — RQD — REC
LIQUID LIMIT △ PLASTIC LIMIT ×
CALIBRATED PENETROMETER TSF ○ (1 2 3 4 5)
WATER CONTENT % ● [FINES CONTENT] % (10 20 30 40 50)


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| ▽ WL (First Encountered) | BORING STARTED: **May 09 2023** | | CAVE IN DEPTH: |
| ▼ WL (Completion) **3.00** | BORING COMPLETED: **May 09 2023** | | HAMMER TYPE: **Auto** |
| ▼ WL (Seasonal High Water) | EQUIPMENT: **Track** | LOGGED BY: **OMA** | DRILLING METHOD: **Mud rotary** |
| ▽ WL (Stabilized) | | | |

**GEOTECHNICAL BOREHOLE LOG**

| CLIENT: | PROJECT NO.: | BORING NO.: | SHEET: |
|---|---|---|---|
| **Onslow County Schools** | **22:33137** | **B-9** | **1 of 1** |
| PROJECT NAME: | DRILLER/CONTRACTOR: | | |
| **Northwoods Park Middle School Addition - PO#20232598** | **Mid Atlantic Drilling, Inc.** | | |
| SITE LOCATION: | | | LOSS OF CIRCULATION |
| **904 Sioux Dr, Jacksonvillle, North Carolina, 28540** | | | |
| NORTHING: | EASTING: | STATION: | SURFACE ELEVATION: / BOTTOM OF CASING |

| DEPTH (FT) | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE DIST. (IN) | RECOVERY (IN) | DESCRIPTION OF MATERIAL | WATER LEVELS | ELEVATION (FT) | BLOWS/6" |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | Topsoil Thickness[3.00"] | | | |
| | S-1 | SS | 18 | 18 | (SM) SILTY FINE SAND, brown, moist to saturated, loose | ▼ | | 3-4-5 (9) |
| | S-2 | SS | 18 | 18 | | | | 3-4-4 (8) |
| 5 | | | | | | | -5 | |
| | S-3 | SS | 18 | 18 | (SP) FINE SAND, brown, saturated, medium dense | | | 3-6-7 (13) |
| | S-4 | SS | 18 | 18 | (SP-SM) FINE SAND WITH SILT, gray, saturated, very loose | | | 2-2-2 (4) |
| 10 | | | | | **END OF BORING AT 10 FT** | | -10 | |
| 15 | | | | | | | -15 | |
| 20 | | | | | | | -20 | |
| 25 | | | | | | | -25 | |
| 30 | | | | | | | | |

STANDARD PENETRATION BLOWS/FT (20 40 60 80 100)
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC

LIQUID LIMIT
PLASTIC LIMIT
CALIBRATED PENETROMETER TSF (1 2 3 4 5)
WATER CONTENT %
[FINES CONTENT] % (10 20 30 40 50)

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| ▽ WL (First Encountered) | BORING STARTED: **May 09 2023** | | CAVE IN DEPTH: |
| ▼ WL (Completion) **3.00** | BORING COMPLETED: **May 09 2023** | | HAMMER TYPE: **Auto** |
| ▼ WL (Seasonal High Water) | EQUIPMENT: **Track** | LOGGED BY: **OMA** | DRILLING METHOD: **Mud rotary** |
| ▽ WL (Stabilized) | | | |

**GEOTECHNICAL BOREHOLE LOG**

| CLIENT: | PROJECT NO.: | BORING NO.: | SHEET: |
|---|---|---|---|
| **Onslow County Schools** | **22:33137** | **B-10** | **1 of 1** |
| PROJECT NAME: | DRILLER/CONTRACTOR: | | |
| **Northwoods Park Middle School Addition - PO#20232598** | **Mid Atlantic Drilling, Inc.** | | |
| SITE LOCATION: | | | LOSS OF CIRCULATION |
| **904 Sioux Dr, Jacksonvillle, North Carolina, 28540** | | | |
| NORTHING: | EASTING: | STATION: | SURFACE ELEVATION: / BOTTOM OF CASING |

| DEPTH (FT) | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE DIST. (IN) | RECOVERY (IN) | DESCRIPTION OF MATERIAL | WATER LEVELS | ELEVATION (FT) | BLOWS/6" |
|---|---|---|---|---|---|---|---|---|
| | | | | | Topsoil Thickness[3.00"] | | | |
| | S-1 | SS | 18 | 18 | (SM) SILTY FINE SAND, brown to gray, moist to saturated, very loose | | | 2-2-1 (3) |
| | S-2 | SS | 18 | 18 | | ▼ | | 1-1-2 (3) |
| 5 | | | | | | | -5 | |
| | S-3 | SS | 18 | 18 | (SP) FINE SAND, gray, saturated, medium dense | | | 4-5-6 (11) |
| | S-4 | SS | 18 | 18 | (SP-SM) FINE SAND WITH SILT, gray, saturated, very loose | | | 1-2-2 (4) |
| 10 | | | | | **END OF BORING AT 10 FT** | | -10 | |
| 15 | | | | | | | -15 | |
| 20 | | | | | | | -20 | |
| 25 | | | | | | | -25 | |
| 30 | | | | | | | | |

⊗ STANDARD PENETRATION BLOWS/FT (20 40 60 80 100)
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC

△ LIQUID LIMIT
× PLASTIC LIMIT
○ CALIBRATED PENETROMETER TSF (1 2 3 4 5)
● WATER CONTENT %
[FINES CONTENT] % (10 20 30 40 50)


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| ▽ WL (First Encountered) | BORING STARTED: **May 09 2023** | | CAVE IN DEPTH: |
| ▼ WL (Completion) **4.00** | BORING COMPLETED: **May 09 2023** | | HAMMER TYPE: **Auto** |
| ▼ WL (Seasonal High Water) | EQUIPMENT: **Track** | LOGGED BY: **OMA** | DRILLING METHOD: **Mud rotary** |
| ▽ WL (Stabilized) | | | |

**GEOTECHNICAL BOREHOLE LOG**

| CLIENT: | PROJECT NO.: | BORING NO.: | SHEET: |
|---|---|---|---|
| **Onslow County Schools** | **22:33137** | **B-11** | **1 of 1** |
| PROJECT NAME: | DRILLER/CONTRACTOR: | | |
| **Northwoods Park Middle School Addition - PO#20232598** | **Mid Atlantic Drilling, Inc.** | | |
| SITE LOCATION: | | | LOSS OF CIRCULATION |
| **904 Sioux Dr, Jacksonvillle, North Carolina, 28540** | | | |
| NORTHING: | EASTING: | STATION: | SURFACE ELEVATION: / BOTTOM OF CASING |

| DEPTH (FT) | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE DIST. (IN) | RECOVERY (IN) | DESCRIPTION OF MATERIAL | WATER LEVELS | ELEVATION (FT) | BLOWS/6" |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | Topsoil Thickness[3.00"] | | | |
| | S-1 | SS | 18 | 18 | (SM) SILTY FINE SAND, brown, moist to saturated, loose to very loose | | | 2-3-2 (5) |
| | S-2 | SS | 18 | 18 | | ▼ | | 1-2-1 (3) |
| 5 | | | | | | | -5 | |
| | S-3 | SS | 18 | 18 | (SP) FINE SAND, tan, saturated, very loose | | | 1-1-1 (2) |
| | S-4 | SS | 18 | 18 | (SP-SM) FINE SAND WITH SILT, gray, saturated, loose | | | 2-3-2 (5) |
| 10 | | | | | **END OF BORING AT 10 FT** | | -10 | |
| 15 | | | | | | | -15 | |
| 20 | | | | | | | -20 | |
| 25 | | | | | | | -25 | |
| 30 | | | | | | | | |

⊗ STANDARD PENETRATION BLOWS/FT (20 40 60 80 100)
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC

△ LIQUID LIMIT
× PLASTIC LIMIT
○ CALIBRATED PENETROMETER TSF (1 2 3 4 5)
● WATER CONTENT %
[FINES CONTENT] % (10 20 30 40 50)

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| ▽ WL (First Encountered) | | BORING STARTED: **May 09 2023** | CAVE IN DEPTH: |
| ▼ WL (Completion) | **4.00** | BORING COMPLETED: **May 09 2023** | HAMMER TYPE: **Auto** |
| ⧩ WL (Seasonal High Water) | | EQUIPMENT: **Track** / LOGGED BY: **OMA** | DRILLING METHOD: **Mud rotary** |
| ⧩ WL (Stabilized) | | | |

**GEOTECHNICAL BOREHOLE LOG**

| CLIENT: | PROJECT NO.: | BORING NO.: | SHEET: |
|---|---|---|---|
| **Onslow County Schools** | **22:33137** | **B-12** | **1 of 1** |
| PROJECT NAME: | DRILLER/CONTRACTOR: | | |
| **Northwoods Park Middle School Addition - PO#20232598** | **Mid Atlantic Drilling, Inc.** | | |
| SITE LOCATION: | | | LOSS OF CIRCULATION |
| **904 Sioux Dr, Jacksonvillle, North Carolina, 28540** | | | |
| NORTHING: | EASTING: | STATION: | SURFACE ELEVATION: / BOTTOM OF CASING |

| DEPTH (FT) | SAMPLE NUMBER | SAMPLE TYPE | SAMPLE DIST. (IN) | RECOVERY (IN) | DESCRIPTION OF MATERIAL | WATER LEVELS | ELEVATION (FT) | BLOWS/6" |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | Topsoil Thickness[3.00"] | | | |
| | S-1 | SS | 18 | 18 | (SM) SILTY FINE SAND, brown, moist to saturated, loose | | | 2-4-4 (8) |
| | | | | | (SP) FINE SAND, tan to gray, saturated, loose | | | |
| 5 | S-2 | SS | 18 | 18 | | | -5 | 4-5-5 (10) |
| | S-3 | SS | 18 | 18 | | | | 3-3-3 (6) |
| | | | | | (SP-SM) FINE SAND WITH SILT, gray, saturated, very loose | | | |
| 10 | S-4 | SS | 18 | 18 | **END OF BORING AT 10 FT** | | -10 | 2-2-2 (4) |
| 15 | | | | | | | -15 | |
| 20 | | | | | | | -20 | |
| 25 | | | | | | | -25 | |
| 30 | | | | | | | | |

STANDARD PENETRATION BLOWS/FT (20 40 60 80 100)
ROCK QUALITY DESIGNATION & RECOVERY
RQD
REC

LIQUID LIMIT
PLASTIC LIMIT
CALIBRATED PENETROMETER TSF (1 2 3 4 5)
WATER CONTENT %
[FINES CONTENT] % (10 20 30 40 50)

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

| | | | |
|---|---|---|---|
| WL (First Encountered) | BORING STARTED: **May 09 2023** | | CAVE IN DEPTH: |
| WL (Completion) **3.00** | BORING COMPLETED: **May 09 2023** | | HAMMER TYPE: **Auto** |
| WL (Seasonal High Water) | EQUIPMENT: **Track** | LOGGED BY: **OMA** | DRILLING METHOD: **Mud rotary** |
| WL (Stabilized) | | | |

**GEOTECHNICAL BOREHOLE LOG**

| CLIENT: | PROJECT NO.: | SHEET: |
|---|---|---|
| **Onslow County Schools** | **22:33137** | **1 of 1** |
| PROJECT NAME: | HAND AUGER NO.: | SURFACE ELEVATION: |
| **Northwoods Park Middle School Addition - PO#20232598** | **K-07** | |
| SITE LOCATION: | | STATION: |
| **904 Sioux Dr, Jacksonvillle, North Carolina, 28540** | | |
| NORTHING: | EASTING: | |

| DEPTH (FT) | WATER LEVELS | ELEVATION (FT) | DESCRIPTION OF MATERIAL | EXCAVATION EFFORT | DCP | SAMPLE NUMBER | FINES CONTENT (%) | MOISTURE CONTENT (%) |
|---|---|---|---|---|---|---|---|---|
| | | | Topsoil Thickness[3.00"] | | | | | |
| | ▼ | | (SM) SILTY FINE SAND, gray/ brown, moist to saturated | | | | | |
| | | | **END OF HAND AUGER AT 4 FT** | | | | | |
| 5 | | | | | | | | |

*REMARKS:*

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

| ▽ WL (First Encountered) | ▼ WL (Seasonal High) | ECS REP: | DATE COMPLETED: | UNITS: | CAVE-IN-DEPTH: |
|---|---|---|---|---|---|
| ▼ WL (Completion) **2.50** | | **OMA** | **May 01 2023** | **English** | **3.00** |

## HAND AUGER LOG

# DCP TEST DATA

**Project:** *Northwoods Park Middle School*
**Date:** 1-May-23
**Location:** K-7
**Soil Type(s):** SAND (SM)

Hammer
○ 10.1 lbs.
● 17.6 lbs.
○ Both hammers used

Soil Type
○ CH
○ CL
● All other soils

| No. of Blows | Accumulative Penetration (mm) | Type of Hammer |
|---|---|---|
| 0 | 0 | 1 |
| 5 | 246.38 | 1 |
| 5 | 551.18 | 1 |
| 5 | 736.6 | 1 |
| 3 | 914.4 | 1 |
| | | 1 |
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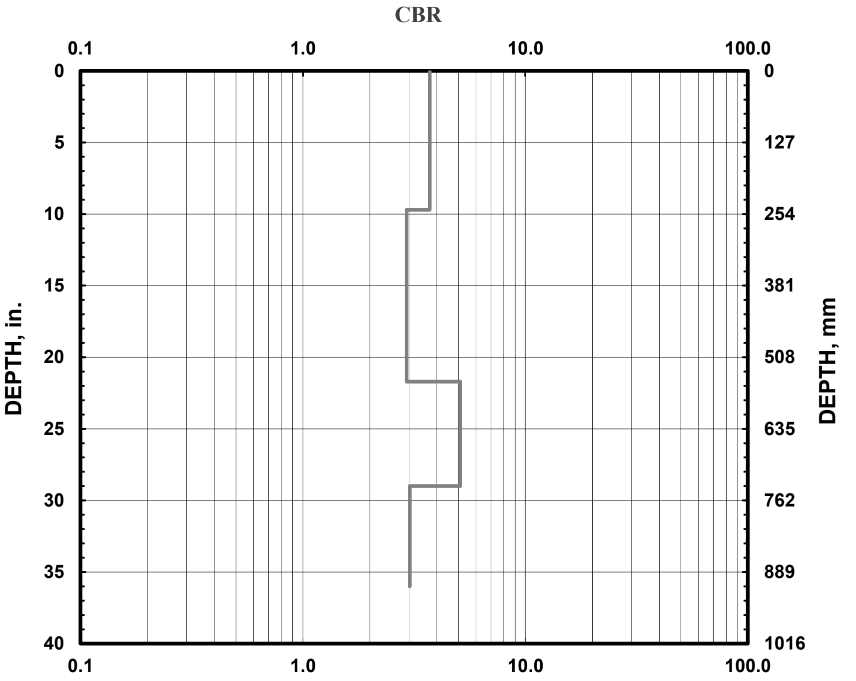
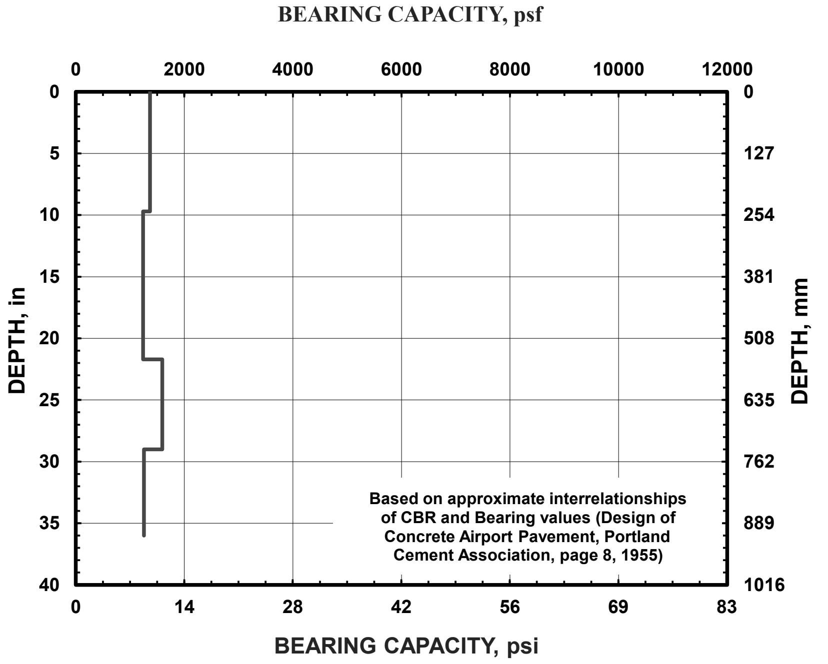

CBR


BEARING CAPACITY, psf

Based on approximate interrelationships of CBR and Bearing values (Design of Concrete Airport Pavement, Portland Cement Association, page 8, 1955)

| CLIENT: | PROJECT NO.: | SHEET: |
|---|---|---|
| **Onslow County Schools** | **22:33137** | **1 of 1** |
| PROJECT NAME: | HAND AUGER NO.: | SURFACE ELEVATION: |
| **Northwoods Park Middle School Addition - PO#20232598** | **K-08** | |
| SITE LOCATION: | | STATION: |
| **904 Sioux Dr, Jacksonvillle, North Carolina, 28540** | | |
| NORTHING: | EASTING: | |

| DEPTH (FT) | WATER LEVELS | ELEVATION (FT) | DESCRIPTION OF MATERIAL | EXCAVATION EFFORT | DCP | SAMPLE NUMBER | FINES CONTENT (%) | MOISTURE CONTENT (%) |
|---|---|---|---|---|---|---|---|---|
| | | | Topsoil Thickness[4.00"] | | | | | |
| | ▼ | | (SM) SILTY FINE SAND, gray to brown, moist to saturated | | | | | |
| | | | **END OF HAND AUGER AT 4 FT** | | | | | |
| 5 | | | | | | | | |

*REMARKS:*

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

| ▽ WL (First Encountered) | ▼ WL (Seasonal High) | ECS REP: | DATE COMPLETED: | UNITS: | CAVE-IN-DEPTH: |
|---|---|---|---|---|---|
| ▼ WL (Completion) **3.00** | | **OMA** | **May 01 2023** | **English** | **3.50** |

## HAND AUGER LOG

# DCP TEST DATA

**Project:** *Northwoods Park Middle School* **Date:** 1-May-23

**Location:** K-8 **Soil Type(s):** SAND (SM)

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

| No. of Blows | Accumulative Penetration (mm) | Type of Hammer |
|---|---|---|
| 0 | 0 | 1 |
| 5 | 187.96 | 1 |
| 5 | 294.64 | 1 |
| 5 | 373.38 | 1 |
| 5 | 439.42 | 1 |
| 5 | 530.86 | 1 |
| 5 | 764.54 | 1 |
| 4 | 927.1 | 1 |
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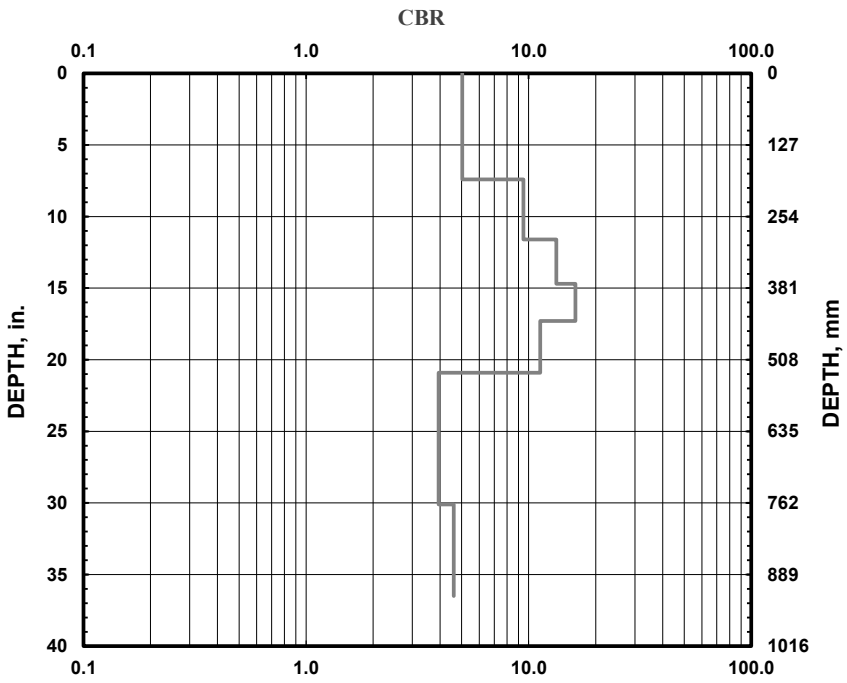


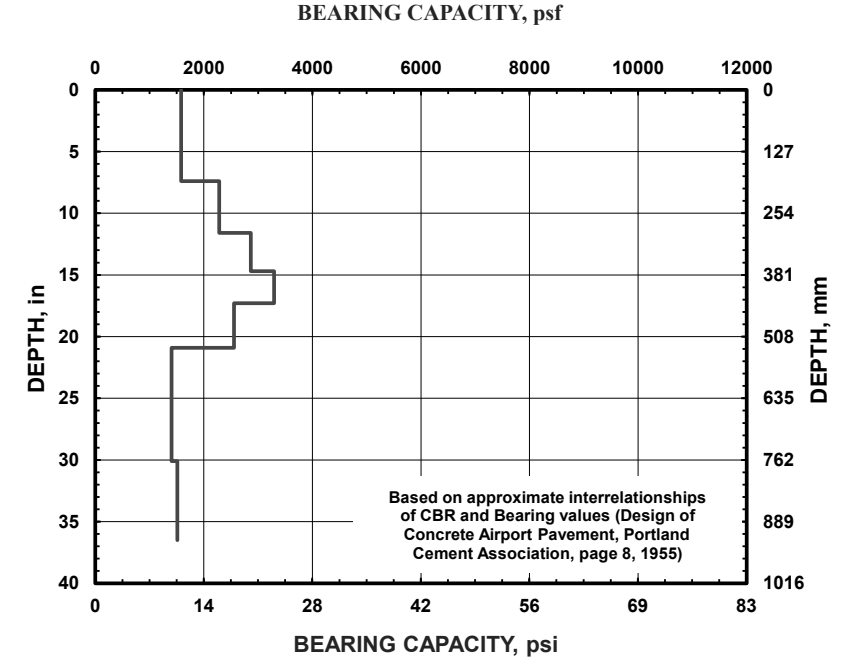

| CLIENT: | PROJECT NO.: | SHEET: |
|---|---|---|
| **Onslow County Schools** | **22:33137** | **1 of 1** |
| PROJECT NAME: | HAND AUGER NO.: | SURFACE ELEVATION: |
| **Northwoods Park Middle School Addition - PO#20232598** | **K-09** | |
| SITE LOCATION: | | STATION: |
| **904 Sioux Dr, Jacksonvillle, North Carolina, 28540** | | |
| NORTHING: | EASTING: | |

| DEPTH (FT) | WATER LEVELS | ELEVATION (FT) | DESCRIPTION OF MATERIAL | EXCAVATION EFFORT | DCP | SAMPLE NUMBER | FINES CONTENT (%) | MOISTURE CONTENT (%) |
|---|---|---|---|---|---|---|---|---|
| | | | Topsoil Thickness[3.00"] | | | | | |
| | ▼ | | (SM) SILTY FINE SAND, brown, moist to saturated | | | | | |
| | | | **END OF HAND AUGER AT 4 FT** | | | | | |
| 5 | | | | | | | | |

*REMARKS:*

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

| ▽ WL (First Encountered) | ▼ WL (Seasonal High) | ECS REP: | DATE COMPLETED: | UNITS: | CAVE-IN-DEPTH: |
|---|---|---|---|---|---|
| ▼ WL (Completion) **2.50** | | **OMA** | **May 01 2023** | **English** | **3.00** |

## HAND AUGER LOG

# DCP TEST DATA

**Project:** *Northwoods Park Middle School* **Date:** 1-May-23

**Location:** K-9 **Soil Type(s):** SAND (SM)

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

| No. of Blows | Accumulative Penetration (mm) | Type of Hammer |
|---|---|---|
| 0 | 0 | 1 |
| 5 | 213.36 | 1 |
| 5 | 353.06 | 1 |
| 5 | 441.96 | 1 |
| 5 | 546.1 | 1 |
| 5 | 683.26 | 1 |
| 5 | 807.72 | 1 |
| 5 | 914.4 | 1 |
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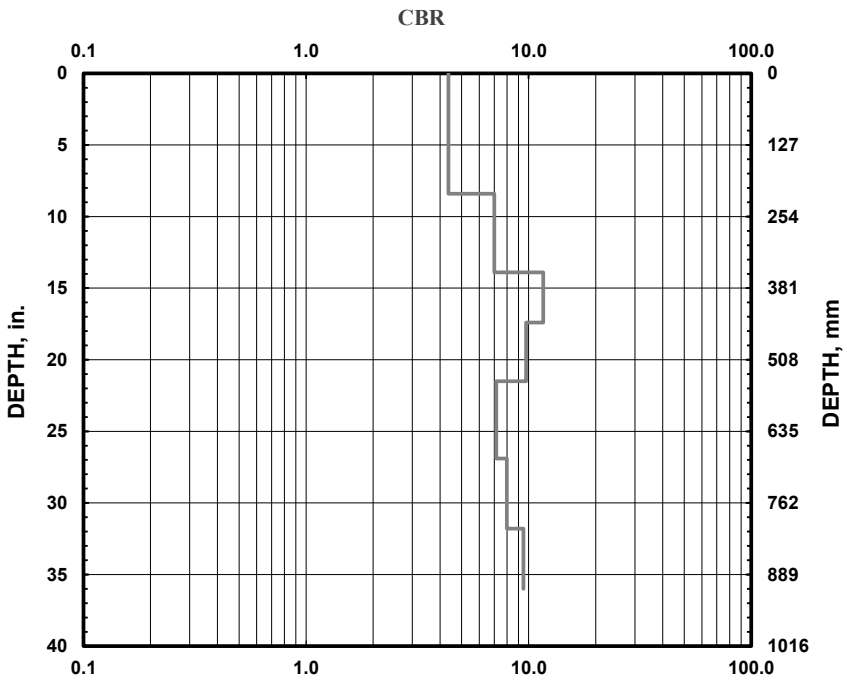


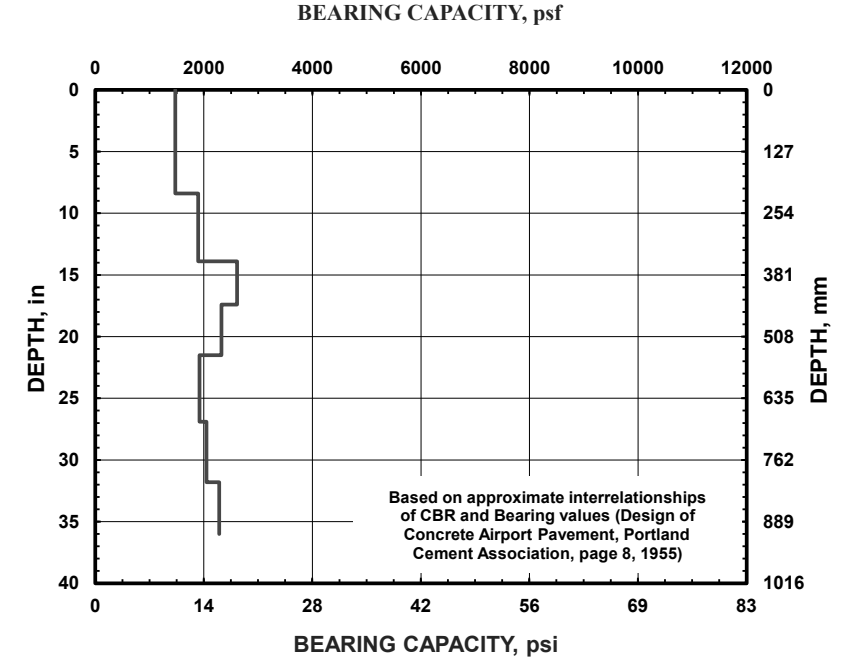

| CLIENT: | PROJECT NO.: | SHEET: |
|---|---|---|
| **Onslow County Schools** | **22:33137** | **1 of 1** |
| PROJECT NAME: | HAND AUGER NO.: | SURFACE ELEVATION: |
| **Northwoods Park Middle School Addition - PO#20232598** | **K-10** | |
| SITE LOCATION: | | STATION: |
| **904 Sioux Dr, Jacksonvillle, North Carolina, 28540** | | |
| NORTHING: | EASTING: | |

| DEPTH (FT) | WATER LEVELS | ELEVATION (FT) | DESCRIPTION OF MATERIAL | EXCAVATION EFFORT | DCP | SAMPLE NUMBER | FINES CONTENT (%) | MOISTURE CONTENT (%) |
|---|---|---|---|---|---|---|---|---|
| | | | Topsoil Thickness[4.00"] | | | | | |
| | ▼ | | (SM) SILTY FINE SAND, gray to brown, moist | | | | | |
| | | | **END OF HAND AUGER AT 4 FT** | | | | | |
| 5 | | | | | | | | |

*REMARKS:*

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

| ▽ WL (First Encountered) | ▼ WL (Seasonal High) | ECS REP: | DATE COMPLETED: | UNITS: | CAVE-IN-DEPTH: |
|---|---|---|---|---|---|
| ▼ WL (Completion) **3.10** | | **OMA** | **May 01 2023** | **English** | **3.00** |

## HAND AUGER LOG

# DCP TEST DATA

**Project:** *Northwoods Park Middle School* **Date:** 1-May-23
**Location:** K-10 **Soil Type(s):** SAND (SM)

Hammer
○ 10.1 lbs.
● 17.6 lbs.
○ Both hammers used

Soil Type
○ CH
○ CL
● All other soils

| No. of Blows | Accumulative Penetration (mm) | Type of Hammer |
|---|---|---|
| 0 | 0 | 1 |
| 5 | 213.36 | 1 |
| 5 | 396.24 | 1 |
| 5 | 561.34 | 1 |
| 5 | 754.38 | 1 |
| 2 | 919.48 | 1 |
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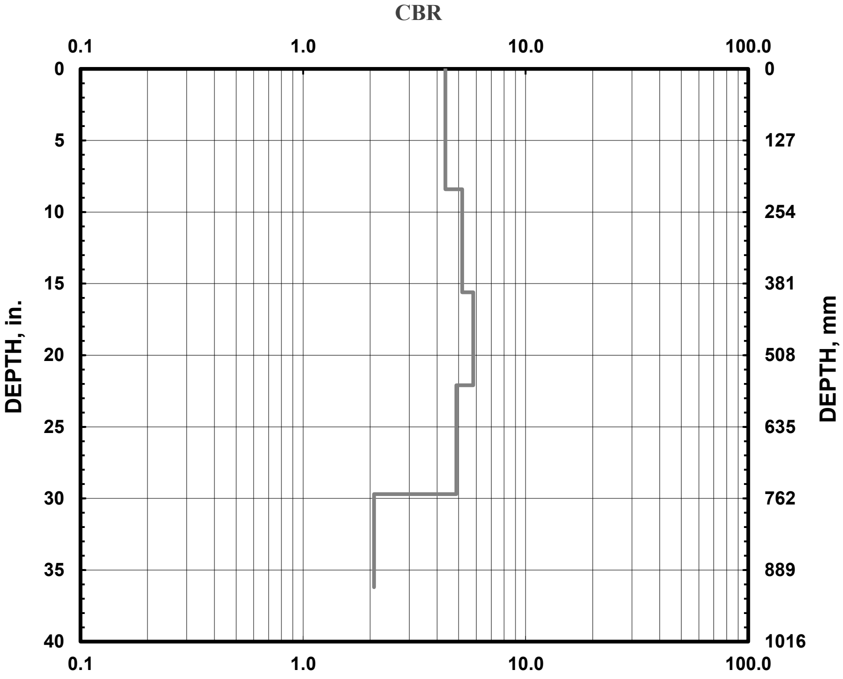

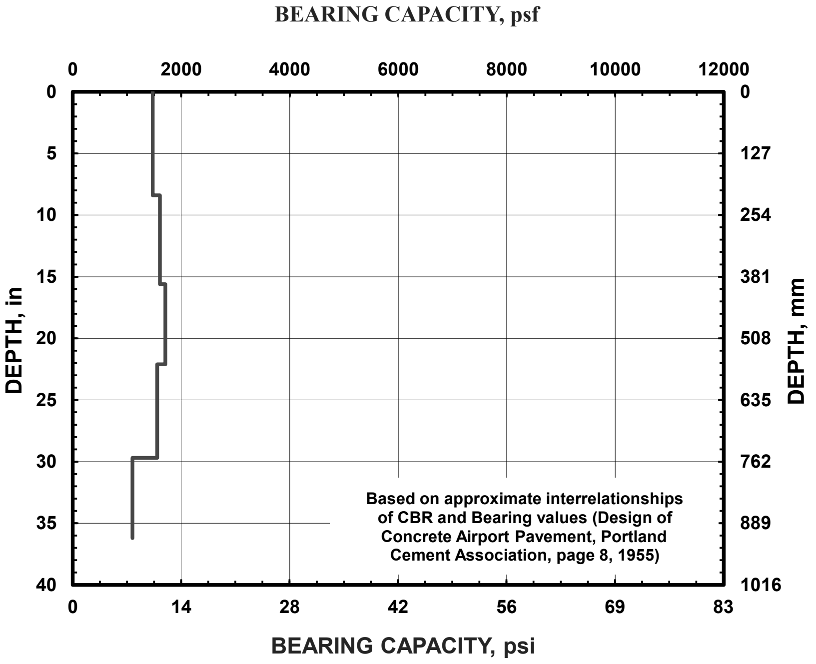

Based on approximate interrelationships of CBR and Bearing values (Design of Concrete Airport Pavement, Portland Cement Association, page 8, 1955)

| CLIENT: | PROJECT NO.: | SHEET: |
|---|---|---|
| **Onslow County Schools** | **22:33137** | **1 of 1** |
| PROJECT NAME: | HAND AUGER NO.: | SURFACE ELEVATION: |
| **Northwoods Park Middle School Addition - PO#20232598** | **K-11** | |
| SITE LOCATION: | | STATION: |
| **904 Sioux Dr, Jacksonvillle, North Carolina, 28540** | | |
| NORTHING: | EASTING: | |

| DEPTH (FT) | WATER LEVELS | ELEVATION (FT) | DESCRIPTION OF MATERIAL | EXCAVATION EFFORT | DCP | SAMPLE NUMBER | FINES CONTENT (%) | MOISTURE CONTENT (%) |
|---|---|---|---|---|---|---|---|---|
| | | | Topsoil Thickness[5.00"] | | | | | |
| | ▼ | | (SM) SILTY FINE SAND, brown to gray, moist | | | | | |
| | | | **END OF HAND AUGER AT 4 FT** | | | | | |
| 5 | | | | | | | | |

*REMARKS:*

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

| ▽ WL (First Encountered) | ▼ WL (Seasonal High) | ECS REP: | DATE COMPLETED: | UNITS: | CAVE-IN-DEPTH: |
|---|---|---|---|---|---|
| ▼ WL (Completion) **3.50** | | **OMA** | **May 01 2023** | **English** | |

## HAND AUGER LOG

# DCP TEST DATA

**Project:** *Northwoods Park Middle School* **Date:** 1-May-23

**Location:** K-11 **Soil Type(s):** SAND (SM)

Hammer
○ 10.1 lbs.
● 17.6 lbs.
○ Both hammers used

Soil Type
○ CH
○ CL
● All other soils

| No. of Blows | Accumulative Penetration (mm) | Type of Hammer |
|---|---|---|
| 0 | 0 | 1 |
| 5 | 203.2 | 1 |
| 5 | 347.98 | 1 |
| 5 | 490.22 | 1 |
| 5 | 693.42 | 1 |
| 3 | 850.9 | 1 |
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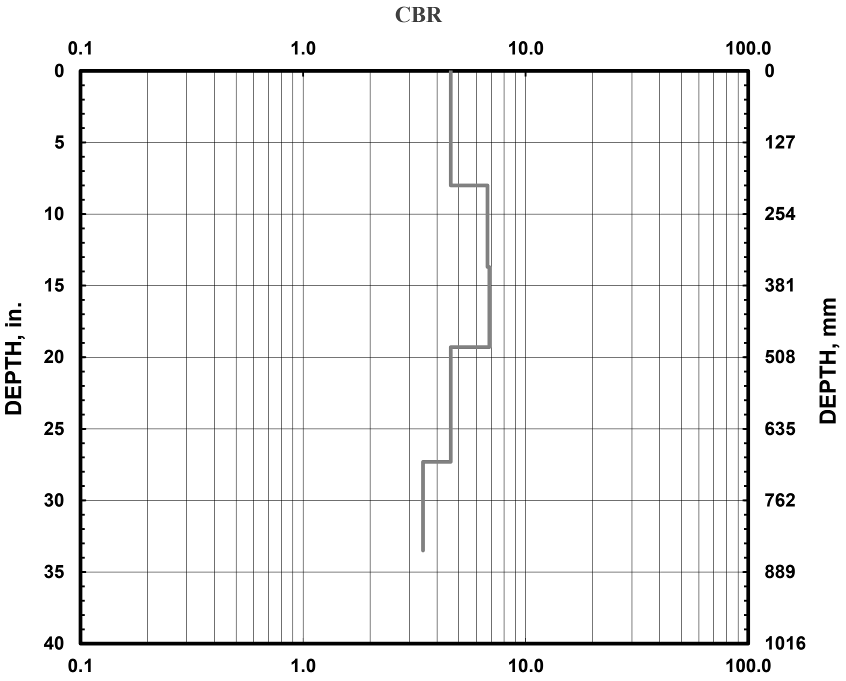
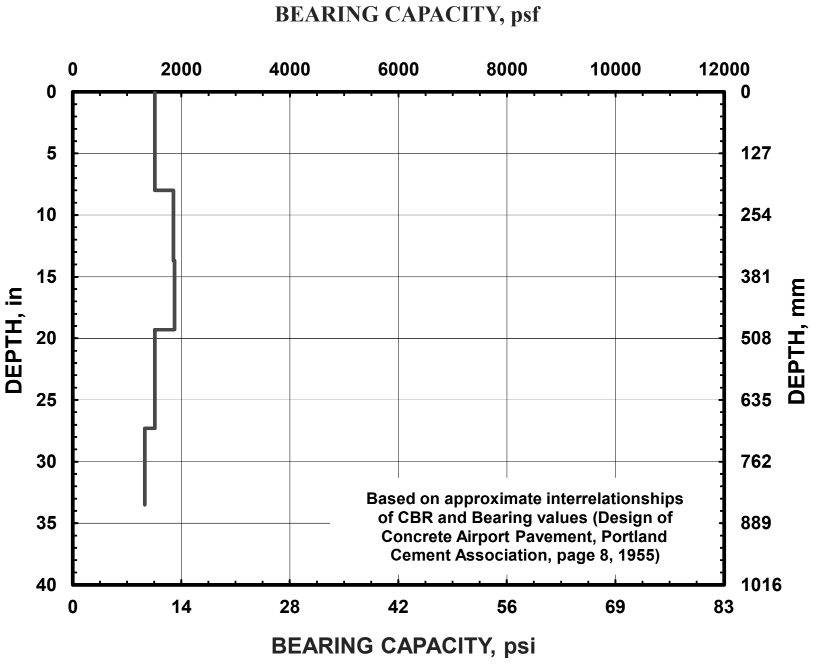

CBR


BEARING CAPACITY, psf

Based on approximate interrelationships of CBR and Bearing values (Design of Concrete Airport Pavement, Portland Cement Association, page 8, 1955)

| CLIENT: | PROJECT NO.: | SHEET: |
|---|---|---|
| **Onslow County Schools** | **22:33137** | **1 of 1** |
| PROJECT NAME: | HAND AUGER NO.: | SURFACE ELEVATION: |
| **Northwoods Park Middle School Addition - PO#20232598** | **K-12** | |
| SITE LOCATION: | | STATION: |
| **904 Sioux Dr, Jacksonvillle, North Carolina, 28540** | | |
| NORTHING: | EASTING: | |

| DEPTH (FT) | WATER LEVELS | ELEVATION (FT) | DESCRIPTION OF MATERIAL | EXCAVATION EFFORT | DCP | SAMPLE NUMBER | FINES CONTENT (%) | MOISTURE CONTENT (%) |
|---|---|---|---|---|---|---|---|---|
| | | | Topsoil Thickness[4.00"] | | | | | |
| | | | (SM) SILTY FINE SAND, brown, moist | | | | | |
| | | | (SM) SILTY FINE SAND, brown, moist, with roots | | | | | |
| | ▼ | | (SM) SILTY FINE SAND, gray, moist to saturated | | | | | |
| | | | **END OF HAND AUGER AT 4 FT** | | | | | |
| 5 | | | | | | | | |

*REMARKS:*

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

| ▽ WL (First Encountered) | ▼ WL (Seasonal High) | ECS REP: | DATE COMPLETED: | UNITS: | CAVE-IN-DEPTH: |
|---|---|---|---|---|---|
| ▼ WL (Completion) **3.60** | | **OMA** | **May 01 2023** | **English** | |

## HAND AUGER LOG

# DCP TEST DATA

**Project:** *Northwoods Park Middle School* **Date:** 1-May-23

**Location:** K-12 **Soil Type(s):** SAND (SM)

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

| No. of Blows | Accumulative Penetration (mm) | Type of Hammer |
|---|---|---|
| 0 | 0 | 1 |
| 5 | 246.38 | 1 |
| 5 | 510.54 | 1 |
| 5 | 617.22 | 1 |
| 5 | 683.26 | 1 |
| 5 | 754.38 | 1 |
| 5 | 850.9 | 1 |
| 2 | 914.4 | 1 |
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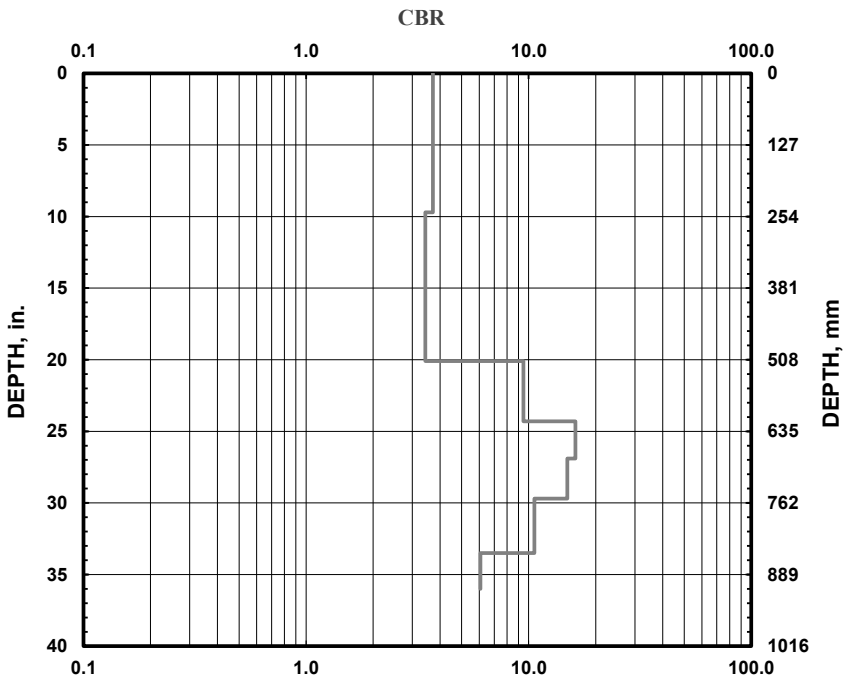


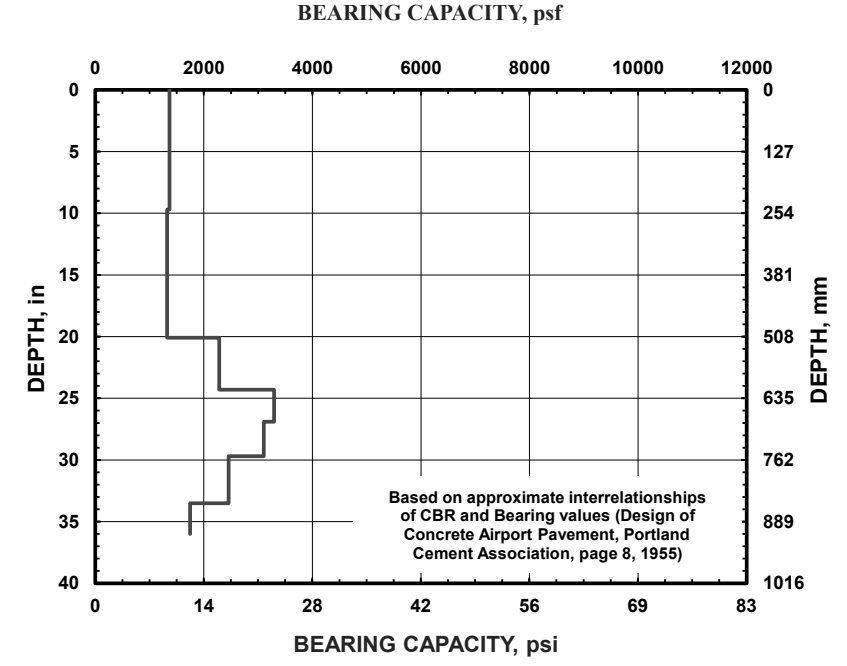

## APPENDIX D – Supplemental Report Documents

GBA Document

# Important Information about This

# Geotechnical-Engineering Report

**Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.**

**While you cannot eliminate all such risks, you can manage them. The following information is provided to help.**

**The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.**

## Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled*. No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

## Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

## You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

## This Report May Not Be Reliable

*Do not rely on this report* if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

## Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed*. The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

## This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation*.

## This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

## Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

## Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

## Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

## Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

May 16, 2023

Mr. Dusty Oliver
Onslow County Schools
200 Broadhurst Road
Jacksonville, North Carolina 28541

Reference: Report of Seasonal High Water Table Estimation and Infiltration Testing
Northwoods Park Middle School
Jacksonville, Onslow County, North Carolina
ECS Project No. 49.20288A

Dear Mr. Oliver:

ECS Southeast, LLP (ECS) recently conducted a seasonal high water table (SHWT) estimation and infiltration testing within the stormwater control measure (SCM) area(s) at 904 Sioux Drive in Jacksonville, Onslow County, North Carolina. This letter, with attachments, is the report of our testing.

**Field Testing**

On May 15, 2023, ECS conducted an exploration of the subsurface soil and groundwater conditions, in accordance with the NCDEQ Stormwater Design Manual section A-2, at two requested locations shown on the attached Boring Location Plan (Figure 1). ECS used GPS equipment in order to determine the boring locations. The purpose of this exploration was to obtain subsurface information of the in situ soils for the SCM area(s). ECS explored the subsurface soil and groundwater conditions by advancing one hand auger boring into the existing ground surface at each of the requested boring locations. ECS visually classified the subsurface soils and obtained representative samples of each soil type encountered. ECS also recorded the SHWT and groundwater elevation observed at the time of the hand auger borings. The attached Infiltration Testing Form provides a summary of the subsurface conditions encountered at the hand auger boring locations.

The SHWT elevation was estimated at the boring locations below the existing grade elevation. A summary of the findings are as follows:

| Location | SHWT |
|---|---|
| I-1 | 15 inches |
| I-2 | 30 inches |

ECS has conducted two infiltration tests utilizing a compact constant head permeameter near the hand auger borings in order to estimate the infiltration rate for the subsurface soils. Infiltration tests are typically conducted at two feet above the SHWT or in the most restrictive soil horizon Tests in clayey conditions are conducted for durations of up to 30 minutes. If a more precise hydraulic conductivity value is desired for these locations, then ECS recommends collecting samples and performing laboratory permeability testing.

**Field Test Results**

Below is a summary of the infiltration test results:

| Location | Description | Depth | Inches/ hour |
|---|---|---|---|
| I-1 | Brown/gray clayey SILT | 12 inches | <0.001 |
| I-2 | Brown/gray clayey SAND | 18 inches | 0.05 |

Infiltration rates and SHWT may vary within the proposed site due to changes in elevation, soil classification and subsurface conditions. ECS recommends that a licensed surveyor provide the elevations of the boring locations.

**Closure**

ECS's analysis of the site has been based on our understanding of the site, the project information provided to us, and the data obtained during our exploration. If the project information provided to us is changed, please contact us so that our recommendations can be reviewed and appropriate revisions provided, if necessary. The discovery of any site or subsurface conditions during construction which deviate from the data outlined in this exploration should be reported to us for our review, analysis and revision of our recommendations, if necessary. The assessment of site environmental conditions for the presence of pollutants in the soil and groundwater of the site is beyond the scope of this geotechnical exploration.

ECS appreciates the opportunity to provide our services to you on this project. If you have any questions concerning this report or this project, please contact us.

Respectfully,

**ECS SOUTHEAST, LLP**

K. Brooks Wall
Project Manager
bwall@ecslimited.com
910-686-9114

W. Brandon Fulton, PSC, PWS, LSS
Environmental Department Manager
bfulton@ecslimited.com
704-525-5152

Attachments: Figure 1 - Boring Location Plan
Infiltration Testing Form
GBA Document


⊗ **APPROXIMATE BORING LOCATIONS**

N
W E
S

**SCALE SHOWN ABOVE**

**Northwoods Park Middle School**
**Jacksonville, Onslow County,**
**North Carolina**

**ECS Project # 49.20288A**
**May 15, 2023**
**JF**

**Figure 1– Boring Location Plan**

**Provided by: Google Earth**

# Infiltration Testing Form
# Northwoods Park Middle School
# Jacksonville, Onslow County, North Carolina
# ECS Project No. 49.20288
# May 15, 2023

| Location | Depth | USCS | Soil Description |
|---|---|---|---|
| I-1 | 0-10” | SM | Black silty SAND |
| | 10”-30” | MH | Brown/gray clayey SILT |

Seasonal High Water Table was estimated to be at 15 inches below the existing grade elevation.
Test was conducted at 12 inches below existing grade elevation
Infiltration Rate: <0.001 inches per hour

| Location | Depth | USCS | Soil Description |
|---|---|---|---|
| I-2 | 0-12” | SM | Brown/gray silty SAND |
| | 12”-40” | SC | Brown/gray clayey SAND |

Seasonal High Water Table was estimated to be at 30 inches below the existing grade elevation.
Test was conducted at 18 inches below existing grade elevation
Infiltration Rate: 0.05 inches per hour

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# Geotechnical-Engineering Report

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- confer with other design-team members,
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- review pertinent elements of other design professionals' plans and specifications, and
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You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

## Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

## Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

## Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

## Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

# SECTION 02 41 16 - STRUCTURE DEMOLITION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:
   1. Demolition and removal of buildings **and site improvements**.
   2. **Removing** below-grade construction.
   3. Disconnecting, capping or sealing, and **removing** site utilities.
   4. Salvaged items by Owner.

B. Related Sections include the following:
   1. Division 01 Section "Summary" for use of the premises and phasing requirements.
   2. Division 01 Section "Temporary Facilities and Controls" for temporary construction, protection facilities, and environmental-protection measures for building demolition operations.
   3. Division 02 Section "Selective Structure Demolition" for partial demolition of buildings, structures, and site improvements.
   4. Division 22 Sections for demolishing or relocating site plumbing items.
   5. Division 26 Sections for demolishing or relocating site electrical items.
   6. Division 31 Section "Site Clearing" for site clearing and removal of above- and below-grade site improvements not part of building demolition.

### 1.3 DEFINITIONS

A. Demolish: Completely remove and legally dispose of off-site.
B. Recycle: Recovery of demolition waste for subsequent processing in preparation for reuse.
C. Salvage: Items to be salvaged by Owner prior to building demolition.

### 1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

### 1.5 SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.
B. Proposed Protection Measures: Submit informational report, including drawings, that indicates the measures proposed for protecting individuals and property**, for environmental protection, for dust control, and for noise control**. Indicate proposed locations and construction of barriers.
   1. Adjacent Buildings: Detail special measures proposed to protect adjacent buildings to remain.
C. Schedule of Building Demolition Activities: Indicate the following:
   1. Detailed sequence of demolition work, with starting and ending dates for each activity.
   2. Temporary interruption of utility services.
   3. Shutoff and capping of utility services.

D. Building Demolition Plans: Drawings indicating the following:
   1. Locations of temporary protection and means of egress for adjacent occupied buildings.
E. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
G. Qualified Demolition Contractor:
   1. Provide documentation that the Demolition Contractor has demolished buildings of similar size and scope as this project.

## 1.6 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
C. Standards: Comply with ANSI A10.6 and NFPA 241.
D. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to building demolition including, but not limited to, the following:
   1. Inspect and discuss condition of construction to be demolished.
   2. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review and finalize protection requirements.
   4. Review procedures for noise control and dust control.
   5. Review procedures for protection of adjacent buildings.

## 1.7 PROJECT CONDITIONS

A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.
B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.
   1. Provide not less than **one week** notice of activities that will affect operations of adjacent occupied buildings.
   2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.
      a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.
C. Owner assumes no responsibility for buildings and structures to be demolished.
   1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
   2. Before building demolition, Owner will remove any items they wish to salvage.
D. Hazardous Materials: Hazardous materials have been tested and no known hazardous material are in existence in the areas of construction or demolition.

## 1.8 COORDINATION

A. Arrangement of demolition schedule so as not to interfere with operations or disruptions of adjacent occupied buildings is a requirement.

PART 2 - PRODUCTS (Not Used)

2.1 SOIL MATERIALS

A. Satisfactory Soils: Comply with requirements in Division 31 Section "Earth Moving."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting demolition operations.
B. Review Project Record Documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
C. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

3.2 PREPARATION

A. Refrigerant: Remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction before starting demolition.
B. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.
   1. Owner will arrange to shut off indicated utilities when requested by Contractor.
   2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
   3. Cut off pipe or conduit a minimum of 24 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
C. Existing Utilities: Refer to Divisions 22 and 26 Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.
D. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
   1. Strengthen or add new supports when required during progress of demolition.

3.3 PROTECTION

A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.
B. Existing Utilities: Maintain utility services to remain and protect from damage during demolition operations.
   1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
   2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.
      a. Provide at least three weeks' notice to occupants of affected buildings if shutdown of service is required during changeover.

C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Division 01 Section "Temporary Facilities and Controls."
   1. Protect adjacent buildings and facilities from damage due to demolition activities.
   2. Protect existing site improvements, appurtenances, and landscaping to remain.
   3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
   4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
   5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
   6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
   7. As necessary, erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.

D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

## 3.4 DEMOLITION, GENERAL

A. General: Demolish indicated existing buildings **and site improvements** completely. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
   2. Maintain fire watch during and for at least 4 hours after flame cutting operations.
   3. Maintain adequate ventilation when using cutting torches.
   4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Engineering Surveys: During demolition, perform surveys to detect hazards that may result from building demolition activities.

C. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
   2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

D. Explosives: Use of explosives is not permitted.

## 3.5 DEMOLITION BY MECHANICAL MEANS

A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
   1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.

C. Salvage: Items to be salvaged by the Owner will be removed prior to the start of construction

D. Below-Grade Construction: Demolish foundation walls and other below-grade construction.
   1. Remove below-grade construction, including basements, foundation walls, and footings, completely.

E. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.
   1. Piping: Disconnect piping at unions, flanges, valves, or fittings.
   2. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.

## 3.6 SITE RESTORATION

A. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in Division 31 Section "Earth Moving."

B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

## 3.7 REPAIRS

A. Promptly repair damage to adjacent buildings caused by demolition operations.

## 3.8 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and legally dispose of them in an EPA-approved landfill acceptable to authorities having jurisdiction.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Do not burn demolished materials.

## 3.9 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

B. Contractor is responsible for the cleaning of any adjacent walkways, roadways, etc. that get contaminated, dirty, or have debris from the demolition and construction activities.

**END OF SECTION 02 41 16**

# SECTION 02 41 19 - SELECTIVE STRUCTURE DEMOLITION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:
   1. Demolition and removal of selected portions of building or structure.
   2. Demolition and removal of selected site elements.
   3. Patching and repairs

B. Related Sections include the following:
   1. Division 00 Section "Special Conditions" for use of premises, and phasing, and Owner-occupancy requirements.
   2. Division 01 Section "Summary" for use of premises, and Owner-occupancy requirements.
   3. Division 01 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
   4. Division 01 Section "Cutting and Patching" for cutting and patching procedures.
   5. Division 02 Section "Structure Demolition" for demolition of entire buildings, structures, and site improvements.
   6. Division 31 Section "Site Clearing" for site clearing and removal of above- and below-grade improvements.

### 1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Reinstall: Detach items from existing construction; clean, service, and otherwise prepare them for reuse, and reinstall them where indicated.

C. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

### 1.4 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option.

B. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.

## 1.5 SUBMITTALS

A. Schedule of Selective Demolition Activities: Indicate the following:
   1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
   2. Interruption of utility services. Do not interrupt utility services unless interruption is coordinated with Owner.
   3. Coordination for shutoff, capping, and continuation of utility services.
   4. Use of elevator and stairs.
   5. Locations of proposed dust- and noise-control temporary partitions and means of egress.
   6. Coordination of Owner's continuing occupancy of existing building and of Owner's partial occupancy of completed Work.
   7. Means of protection for items to remain and items in path of waste removal from building.

B. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.

C. Predemolition Photographs: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Submit before Work begins.

D. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

## 1.6 QUALITY ASSURANCE

A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

B. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

D. Standards: Comply with ANSI A10.6 and NFPA 241.

E. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:
   1. Inspect and discuss condition of construction to be selectively demolished.
   2. Review structural load limitations of existing structure.
   3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
   5. Review areas where existing construction is to remain and requires protection.

## 1.7 PROJECT 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.
   1. Comply with requirements specified in Division 01 Section "Summary."

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is expected that **NO** hazardous materials will be encountered in the Work.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 REPAIR MATERIALS

A. Use repair materials identical to existing materials. Where identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible. Use a material whose installed performance equals or surpasses that of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.
B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
E. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.
F. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.
G. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
   1. Comply with requirements for existing services/systems interruptions specified in Division 01 Section "Summary."
B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated 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. Arrange to shut off indicated utilities with utility companies.
   3. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
   4. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
      a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.3 PREPARATION

A. 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.
   1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."
      a. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
      b. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
      c. Protect existing site improvements, appurtenances, and landscaping to remain. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.

B. Temporary Facilities: 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 Division 01 Section "Temporary Facilities and Controls."
   6. Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.
      a. Construct dustproof partitions of not less than 2 separate layers or 6 mil polyethylene. Seal joints and perimeter. Protect air-handling equipment.

C. Temporary Shoring: 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.

D. Pollution Controls: Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.
   1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
   3. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before start of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. 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, to minimize disturbance of adjacent surfaces. 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. Provide and maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Legally dispose of demolished items and materials promptly

B. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
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.

C. 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.

## 3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Cut concrete to a depth of at least 3/4 inch at junctures with construction to remain, using power-driven saw. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition. 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, then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.

1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.

F. Roofing: Remove no more existing roofing than can be covered in one day by new roofing and so that building interior remains watertight and weathertight. Refer to Division 07 for new roofing requirements.

1. Remove existing roof membrane, flashings, copings, and roof accessories.
2. Remove existing roofing system down to substrate.

G. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

## 3.6 PATCHING AND REPAIRING

A. Patch and Repair holes and damaged surfaces caused to adjacent construction by selective demolition operations. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new

materials. Completely fill holes and depressions in existing masonry walls to remain with an approved masonry patching material, applied according to manufacturer's printed recommendations.

B. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction to remain in a manner that eliminates evidence of patching and refinishing.

C. Patch and repair floor and wall surfaces in the new space where demolished walls or partitions extend one finished area into another. Provide a flush and even surface of uniform color and appearance. Closely match texture and finish of existing adjacent surface. Patch with durable seams that are as invisible as possible. Comply with specified tolerances. Where patching smooth painted surfaces, extend final paint coat over entire unbroken surface containing the patch after the surface has received primer and second coat. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

D. Inspect and test patched areas to demonstrate integrity of the installation, where feasible.

E. Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

## 3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
   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.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

## 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.

## 3.9 SELECTIVE DEMOLITION SCHEDULE

A. Existing items to be removed include but are not limited to areas as indicated and/or reasonably implied on the drawings.

B. Existing Items to Be Removed by Contractor and Returned to Owner. Coordinate with the Owner when this work will be disassembled so the Owner can have someone present to monitor the disassembly.
   1. To be Coordinated with the Owner and Contractor prior to start of Construction.

C. Existing Items to Be Removed and Reinstalled:
   1. To be Coordinated with the Owner and Contractor prior to start of Construction.

D. Existing Items to Remain: Refer to demolition drawings.

**END OF SECTION 02 41 19**

# SECTION 033000 - CAST-IN-PLACE CONCRETE

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

B. Related Sections:

1. Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement.

D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

### 1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Material certificates.

C. Material test reports.

D. Floor surface flatness and levelness measurements.

### 1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

C. Concrete Test Samples:

1. Samples for concrete tests shall be taken in accordance with ASTM C 172, ASTM C31, AND ACI 318.
2. Compressive Strength Tests on concrete: Samples for concrete compressive strength tests of each class of concrete placed each day shall be taken not less than once per day, nor less than once for each 100 yd3 of concrete, nor less than once for each 5000 ft2 surface area for slabs or walls. If the total volume of concrete for a class is such that frequency of testing required is less than five tests, then samples shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5 and Section 7, "Lightweight Concrete."
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

G. Pre-installation Conference: Conduct conference at Project site.

## PART 2 - PRODUCTS

### 2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

### 2.2 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

1. Galvanized Reinforcing Bars: ASTM A 767/A 767M, zinc coated after fabrication and bending.
2. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M, epoxy coated, with less than 2 percent damaged coating in each 12-inch (300-mm) bar length.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

E. Galvanized-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from galvanized-steel wire into flat sheets.

F. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884/A 884M, Class A coated, Type 1, plain steel.

G. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice.

## 2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I/II. Supplement with the following:

a. Fly Ash: ASTM C 618, Class F or C.
b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, graded.

1. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Lightweight Aggregate: ASTM C 330, 3/4-inch (19-mm) nominal maximum aggregate size.

D. Water: ASTM C 94/C 94M and potable.

## 2.4 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will 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 C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

## 2.5 FIBER REINFORCEMENT

A. Synthetic Micro-Fiber: fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches (13 to 38 mm) long.

## 2.6 WATERSTOPS

A. Flexible Rubber Waterstops: CE CRD-C 513, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

B. Chemically Resistant Flexible Waterstops: Thermoplastic elastomer rubber waterstops embedding in concrete to prevent passage of fluids through joints; resistant to oils, solvents, and chemicals. Factory fabricate corners, intersections, and directional changes.

C. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

D. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).

E. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch (10 by 19 mm).

## 2.7 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class C. Include manufacturer's recommended adhesive or pressure-sensitive tape.

B. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 15 mils (0.25 mm) thick.

## 2.8 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, non-dissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

G. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

H. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.9 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber ASTM D 1752, cork or self-expanding cork.

## 2.10 CONCRETE MIXTURES

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, according to ACI 301.

B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

D. Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi (34.5 MPa at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Slump Limit: 4 inches (100 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch (38-mm) nominal maximum aggregate size.
5. Air Content: [6] <Insert number> percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) nominal maximum aggregate size.
6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
7. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.5 lb/cu. yd. (0.90 kg/cu. m).

E. Proportion structural lightweight concrete mixture as follows:

1. Minimum Compressive Strength: 5000 psi (34.5 MPa) at 28 days.
2. Calculated Equilibrium Unit Weight: 110 lb/cu. ft. (1762 kg/cu. M), plus or minus 3 lb/cu. ft. (48.1 kg/cu. m) as determined by ASTM C 567.
3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).

4. Air Content: 6 percent, plus or minus 2 percent at point of delivery for nominal maximum aggregate size greater than 3/8 inch (10 mm).
5. Air content in first subparagraph below is maximum recommended by ACI 302.1R for trowel-finished floors.
6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
7. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.5 lb/cu. yd. (0.90 kg/cu. m).

## 2.11 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

## 2.12 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M[ and ASTM C 1116, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

# PART 3 - EXECUTION

## 3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Retain one of two options in paragraph below. ACI 301 requires chamfers unless otherwise specified.

D. Chamfer exterior corners and edges of permanently exposed concrete.

## 3.2 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. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

## 3.3 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

## 3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

## 3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction 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 contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction 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 will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: 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.

E. Waterstops: Install in construction joints and at other joints indicated according to manufacturer's written instructions.

## 3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

C. Cold-Weather Placement: Comply with ACI 306.1.

D. Hot-Weather Placement: Comply with ACI 301.

## 3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

## 3.8 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in one direction.

1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Re-straighten, cut down high spots, and fill low spots. Re-

peat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and re-straighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated, 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.
2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch (3.2 mm).

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

## 3.9 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for 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. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

    a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufac-

turer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

## 3.10 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

## 3.11 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

END OF SECTION 033000

# SECTION 03 54 16 - HYDRAULIC CEMENT UNDERLAYMENT

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:
   1. Polymer-modified, self-leveling, hydraulic cement underlayment

### 1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

### 1.3 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Hydraulic cement underlayment.
   2. Reinforcement.
   3. Primer.
   4. Surface sealer.

### 1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.

### 1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.
   1. Place hydraulic cement underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F.

## PART 2 - PRODUCTS

### 2.1 HYDRAULIC CEMENT UNDERLAYMENTS

A. Hydraulic Cement Underlayment: Polymer-modified, self-leveling, hydraulic cement product that can be applied in minimum uniform thickness of 1/4 inch and that can be feathered at edges to match adjacent floor elevations.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide ARDEX Americas; K-15 Self-Leveling Underlayment Concrete or comparable product by one of the following:
      a. Dayton Superior.
      b. Euclid Chemical Company (The); an RPM company.
      c. MAPEI Corporation.
      d. Uzin Utz North America, Inc.

2. Cement Binder: ASTM C150/C150M, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C219.
3. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C109/C109M.
4. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer, formulated for use with underlayment when applied to substrate and conditions indicated.

B. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch; or coarse sand as recommended by underlayment manufacturer.
1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.

C. Water: Potable and at a temperature of not more than 70 deg F.

D. Reinforcement: For underlayment applied to wood substrates, provide galvanized metal lath or other corrosion-resistant reinforcement recommended in writing by underlayment manufacturer.

E. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Prepare and clean substrate according to manufacturer's written instructions.
1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
2. Fill substrate voids to prevent underlayment from leaking.

B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.
1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
a. Anhydrous Calcium Chloride Test, ASTM F1869. Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 85 percent relative humidity level measurement, or as recommended by hydraulic cement underlayment manufacturer.

C. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

### 3.2 INSTALLATION

A. Mix and install underlayment components according to manufacturer's written instructions.
1. Close areas to traffic during underlayment installation and for time period after installation recommended in writing by manufacturer.
2. Coordinate installation of components to provide optimum adhesion to substrate and between coats.

3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.

B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Install underlayment to produce uniform, level surface.
1. Install a final layer without aggregate to product surface.
2. Feather edges to match adjacent floor elevations.

D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during installation and curing processes.

E. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.

F. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

**END OF SECTION**

# SECTION 03 92 50 - CONCRETE REPAIR MORTARS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This section includes Portland cement-based, microsilica-modified, fast setting structural repair mortar suitable for overlays, form & pour applications, and full depth repairs.

### 1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

B. Qualifications Data: For Installer

### 1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: The manufacturer shall be a company with at least five years experience and regularly engaged in the manufacture and marketing of products specified herein.

B. Installer Qualifications: Factory- trained applicator

### 1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver products in original packaging, labeled with product identification, manufacturer, batch number and shelf life.

B. Store products in a dry area with temperature maintained between 50° and 85° F and Protect from direct sunlight.

C. Handle products in accordance with manufacturer's printed recommendations.

### 1.5 PROJECT CONDITIONS

A. Do not install material below 50° F surface and air temperatures. Maintain temperature during and for 48 hours after the installation of products.

## PART 2 – PRODUCTS

### 2.1 REPAIR MORTAR

A. Formable, pourable, pumpable, Portland cement-based, microsilica-modified, structural repair mortar for horizontal, vertical, and overhead applications for deteriorated interior and exterior concrete above, on, or below grade.

1. Basis of Design: ARDEX TRM as manufactured by ARDEX Engineered Cements or comparable product by one of the following.
   a. UZIN Utz North America, Inc.
   b. Approved Substitution

B. Performance and Physical Properties: Meet or exceed the following values for material cured at 73° F and 50 percent relative humidity.

1. Compressive Strength (ASTM C109): 2 hours 3500 psi 245.0 kg/cm$^2$, 3 hours 4500 psi 315.0 kg/cm$^2$, 1 day 5750 psi 402.5 kg/cm$^2$, 7 days 7500 psi 525.0 kg/cm$^2$, 28 days 11500 psi 805.0 kg/cm$^2$
2. Flexural Strength (ASTM C78): 7 days 850 psi 59.5 kg/cm$^2$, 28 days 1100 psi 77.0 kg/cm$^2$
3. Splitting Tensile Strength (ASTM C496): 7 days 550 psi 38.5 kg/cm$^2$, 28 days 625 psi 43.75 kg/cm$^2$
4. Modulus of Elasticity: 28 days 3.8 x $10^6$ psi 2.7 x $10^5$ kg/cm$^2$
5. Direct Tensile Bond Strength (ASTM D4541): 28 days 240 psi 16.8 kg/cm$^2$
6. Slant Shear Bond Strength (ASTM C882): 1 day 1250 psi 87.5 kg/cm$^2$, 7 days 2000 psi 140.0 kg/cm$^2$
7. Mortar (Max Scaled Material): 25 cycles 0.008 psf 0.000004 kg/cm$^2$, 50 cycles 0.01 psf 0.000005 kg/cm$^2$
8. Time of Setting (ASTM C191): Initial Set 10 min.
9. Final Set 15 min.
10. Length Change (ASTM C157, 28 days): In Water -0.002%, In Air -0.05%
11. Scaling Resistance / Visual Rating (ASTM C672): 25 cycles 1, 50 cycles 1
12. Pot Life / Working Time: 10 - 20 minutes
13. Time to Traffic: Foot - 2 hours
14. Full, Including Rolling Loads - 6 hours
15. Coat or Seal: Approx. 6 hours
16. Color: Gray

## PART 3 – EXECUTION

### 3.1 PREPARATION

A. General: Prepare substrate in accordance with manufacturer's instructions. Prior to proceeding with any repair, please refer to the International Concrete Repair Institute's ICRI 03730 Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion; ICRI 03732 Guideline for Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays; and the American Concrete Institute's ACI 546R-04 Concrete Repair Guide for general guidelines for concrete repair.

1. All concrete and masonry substrates must be sound, solid, dry, and completely free of all oil, grease, dirt, curing compounds and any substance that might act as a bond breaker. Overwatered, frozen or otherwise weak concrete surfaces must also be cleaned down to sound, solid concrete by mechanical methods such as scarifying, scabbling or similar in accordance with ICRI 03732 before priming.
2. The repair area must be saw cut in a basic rectangular shape at least 1/2" (12 mm) in depth. The cuts should be made at 90° angle, and should be slightly keyed. Chip out the concrete inside the cuts to a minimum depth of 1/2" (12 mm) until the area is squared or box shape.
3. Mechanically prepare surface to obtain an exposed aggregate surface with a minimum surface profile of approximately 1/16" (1.5 mm).
3. For cases with exposed reinforcing steel, mechanically clean the steel to remove all rust and any other contaminants in accordance with ICRI 03730. Prime the steel with manufacturer's bonding & anti-corrosion coating prior to proceeding with repair. For further details

B. Joint Preparation

1. Moving Joints and Cracks – honor all expansion and isolation joints up through the mortar repair. A flexible sealing compound suitable for the application may be installed.

2. Control Joints and dormant cracks greater than 1/16 inch – fill all non-moving joints and cracks with Joint Filler.

3.2 INSTALLATION OF REPAIR MORTAR:

A. Examine substrates and conditions under which materials will be installed. Do not proceed with installation until unsatisfactory conditions are corrected.

B. Coordinate installation with adjacent work to ensure proper sequence of construction. Protect adjacent areas and landscaping from contact due to mixing and handling of materials.

C. Mixing: Comply with manufacturer's printed instructions and the following.

D. Application: Comply with manufacturer's printed instructions and the following.

1. Do not apply in freezing conditions or during precipitation.

2. Comply with manufacturer’s guides for hot and cold weather application.

3. When overlaying, Apply scrub coat of repair mortar into primed or saturated surface dry substrate to ensure intimate contact and establish bond. Apply repair mortar while scrub coat is wet.

4. Steel trowel the mortar to the desired finish once it takes its initial set.

5. Vibrate closed–form repairs to ensure intimate contact with the substrate, establish bond, and ensure proper consolidation. Avoid over-vibration.

E. Curing:

1. Keep surface damp for 48 hours with continuous light water-fogging or curing blanket.

2. If no coating or sealer is to be applied, a water-based curing compound meeting ASTM C309 may be used. Do not use solvent-based curing compounds.

3. Allow to cure a minimum 6 hours before applying any final coatings or sealers.

4. Acceptable for foot traffic in 2 hours and vehicular traffic in 6 hours.

F. Cleaning: Remove excess material before material cures. If material has cured, remove using mechanical methods that will not damage substrate.

**END OF SECTION**

# SECTION 04 20 00 - UNIT MASONRY

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:
   1. Concrete masonry units (CMUs).
   2. Concrete brick.
   3. Face brick.
   4. Grout.
   5. Reinforcing steel.
   6. Masonry joint reinforcement.
   7. Ties and anchors.
   8. Embedded flashing.
   9. Miscellaneous masonry accessories.

B. Related Sections include the following:
   1. Division 04 Section “Masonry Mortaring” for mortar specifications.
   2. Division 07 Section "Dampproofing" for dampproofing applied to cavity face of backup wythes of cavity walls.
   3. Division 07 Section "Water Repellents" for water repellents applied to unit masonry assemblies.
   4. Division 07 Section "Thermal Insulation" for cavity wall insulation type, thickness, and r value.
   5. Division 07 Section “Foam in Place Insulation for cavity wall insulation at areas indicated.
   6. Division 07 Section "Sheet Metal Flashing and Trim" for exposed sheet metal flashing.
   7. Division 07 Section "Joint Sealants" for sealing control and expansion joints in unit masonry.

C. Products furnished, but not installed, under this Section include the following:
   1. Anchor sections of adjustable masonry anchors for connecting to structural frame, installed under Division 05 Section "Structural Steel Framing."

D. Products installed, but not furnished, under this Section include the following:
   1. Steel lintels and shelf angles for unit masonry, furnished under Division 05 Section "Metal Fabrications."

### 1.3 DEFINITIONS

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

### 1.4 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths ($f'_m$) at 28 days.
   1. Determine net-area compressive strength ($f'_m$) of masonry by testing masonry prisms according to ASTM C 1314.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Certification:
   1. The producer shall furnish a letter of certification stating the following;
      a. All aggregate used in the manufacture of the units was produced conforming to ASTM C33.
      b. Product has been tested and certificated by ASTM C 90.
C. Shop drawings:
   1. For reinforcing steel detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
   2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
D. Samples for Verification: For each type and color of the following:
   1. Face brick, in the form of straps of five or more bricks.
   2. Decorative concrete masonry units, in the form of small-scale units.
   3. Colored mortar samples showing the full range of colors available.
   4. Weep holes/vents.
   5. Accessories embedded in masonry.
E. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 for testing indicated, as documented according to ASTM E 548.
B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
   1. Manufacturer shall not have less than 10 years of experience for each type of unit.
C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.
D. Source Limitations for Concrete Masonry Units: Obtain CMU units from a manufacturer with a demonstrated history for providing first quality CMU units suitable for use in exposed work of the type and scope of this project, with units showing dense uniform face texture, square sides, corners, edges and faces, and free of chipped edges and broken corners when delivered to the site. Manufacturers with outdated equipment and worn molds incapable of providing consistently high quality materials will not be considered.
E. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.
F. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Division 01 Section "Quality Requirements" for mockups.
   1. Build sample panels for typical exterior wall in sizes approximately **48 inches** long by **48 inches** high by full thickness.
   2. Where masonry is to match existing, erect panels adjacent and parallel to existing surface.
   3. Clean exposed faces of panels with masonry cleaner indicated.
   4. Protect approved sample panels from the elements with weather-resistant membrane.
   5. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of

workmanship; and other material and construction qualities specifically approved by Architect in writing.

a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

## 1.7 DELIVERY, STORAGE, AND HANDLING

A. Ordering: Comply with manufacture's ordering instructions and lead time requirements to avoid construction delays.

B. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry. Do not double stack pallets of masonry units.

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 aggregates where grading and other required characteristics can be maintained and contamination avoided.

E. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

F. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

## 1.8 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Construction: When the ambient temperature is within the limits indicated, use the following procedures:
   a. 40 to 32 deg F: Heat mixing water or sand to produce mortar temperatures between 40 and 120 deg F .
   b. 32 to 25 deg F: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F. Heat grout materials to produce grout temperatures between 40 and 120 deg F. Maintain mortar and grout above freezing until used in masonry.
   c. 25 to 20 deg F: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F . Heat grout materials to produce grout temperatures between 40 and 120

deg F. Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F if grouting. Use heat on both sides of walls under construction.

d. 20 deg F and Below: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F. Heat grout materials to produce grout temperatures between 40 and 120 deg F. Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F. Provide enclosures and use heat on both sides of walls under construction to maintain temperatures above 32 deg F within the enclosures.

2. Cold-Weather Protection: When the mean daily temperature is within the limits indicated, provide the following protection:
   a. 40 to 25 deg F : Cover masonry with a weather-resistant membrane for 48 hours after construction.
   b. 25 to 20 deg F: Cover masonry with insulating blankets or provide enclosure and heat for 48 hours after construction to prevent freezing. Install wind breaks when wind velocity exceeds 15 mi./h .
   c. 20 deg F and Below: Provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 48 hours after construction.
3. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
1. Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and above.

## 1.9 SPECIAL REQUIREMENTS

A. The work of this section shall be bid and performed by a firm certified as a "North Carolina Masonry Contractors Association Certified Masonry Contractor" as described in the most current version of the NCMCA's "Guide to Masonry Contractor Certification." The masonry subcontractor shall at all times when work is in progress, provide an individual from its own staff, acting as superintendent, designated by the North Carolina Masonry Contractors Association Masonry Contractor Certification Program as a "CMP-Certified Masonry Professional" or "CME-Certified Masonry Executive" (as described in the most current version of the NCMCA's "Guide to Masonry Contractor Certification") on-site to supervise work in progress.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

## 2.2 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not uses units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.3 CONCRETE MASONRY UNITS (CMUs)

A. Shapes: Provide shapes indicated and as follows:
   1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
   2. Provide square-edged units for outside corners, unless otherwise indicated.

B. Concrete Masonry Units: **ASTM C 90 (latest edition)**.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi net average of three units.
   2. Weight Classification: Units shall be lightweight blended with aggregates that comply with ASTM C331 and ASTM C33 with a total mix weight not more than 105 lbs./cuft. and not less than 90lbs/cuft.
   3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
   4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
   5. Aggregates: Do not use aggregates made from pumice, scoria, or tuff. All units will be free of organic impurities that will cause rusting, staining, or popouts and will not contain combustible material. The use of coal cinders, coal ash, bottom ash or other similar waste products are not permitted and shall not be allowed.
   6. CMU used in fire rated walls shall meet UL Design Assembly criteria.
   7. Basis for Design: Oldcastle APG - Adams: Redline
   8. Approved Manufacturers:
      a. Oldcastle APG - Adams
      b. Johnson Concrete
      c. York Building Products
      d. Martinsville Concrete Products
   9. Products offered for substitution shall be pre-approved prior to bidding in accordance with the conditions of the contract documents and shall be so indicated in an addendum prior to bid only. Any other approval shall not be valid.

C. Concrete Building Brick: ASTM C 55.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of **3500 psi**.
   2. Weight Classification: Normal Weight
   3. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.

2.4 BRICK

A. General: Provide shapes indicated and as follows:
   1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.

B. Face Brick: ASTM C 216, Grade SW Type FBX.
   1. Size (Actual Dimensions): **3-5/8 inches** wide by **3-5/8 inches** high by **11-5/8 inches** long.
   2. Bond Pattern: Unless otherwise indicated, lay exposed masonry in **one-third running bond.**
   3. Basis for Design:
      a. Type 1: Palmetto Brick- Flashed Wirecut
      b. Type 2: Palmetto Brick- Whitestone
   4. Provide for one of the following:
      a. Type 1:
         1) Palmetto Brick: Flashed Wirecut
         2) Palmetto Brick: Flashed Smooth
         3) Triangle Brick: Flashed Common
         4) Approved Equal
      b. Type 2:
         1) Palmetto Brick: Whitestone
         2) Approved Equal

## 2.5 MASONRY LINTELS

A. General: Provide masonry lintels complying with requirements below.
B. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

## 2.6 GROUT MATERIALS

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
B. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
C. Aggregate for Grout: ASTM C 404.
    1. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
    2. Available Products:
        a. Addiment Incorporated; Mortar Kick.
        b. Euclid Chemical Company (The); Accelguard 80.
        c. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Morset.
        d. Sonneborn, Div. of ChemRex; Trimix-NCA.
D. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.
    1. Available Products:
        a. Rainbloc by ACM Chemistries
        b. Addiment Incorporated; Mortar Tite.
        c. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.
        d. Master Builders, Inc.
E. Water: Potable.
F. Grout for Unit Masonry: Comply with ASTM C 476, Proportions Specifications. Provide grout with a slump of 8 to 11 inches when placed in the masonry

## 2.7 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M, Grade 60.
B. Masonry Joint Reinforcement, General: ASTM A 951.
    1. Interior Walls: galvanized, carbon steel.
    2. Exterior Walls: Hot-dip galvanized, carbon steel.
    3. Wire Size for Side Rods Interior: 0.148-inch diameter.
    4. Wire Size for Side Rods Exterior: ~~0.188-inch~~ 0.148-inch diameter.
    5. Wire Size for Cross Rods: W1.7 or 0.148-inch diameter.
    6. Wire Size for Veneer Ties: 0.148-inch diameter.
    7. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
    8. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
C. Masonry Joint Reinforcement for Single-Wythe Masonry: Truss type with single pair of side rods.
D. Masonry Joint Reinforcement for Multiwythe Masonry:
    1. Adjustable (two-piece) type, truss design, with one side rod at each face shell of backing wythe and with separate ties that extend into facing wythe. Ties have two hooks that engage eyes or slots in reinforcement and resist movement perpendicular to wall. Ties extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

E. Masonry Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.148-inch- diameter, hot-dip galvanized, carbon-steel continuous wire.

## 2.8 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with eight subparagraphs below, unless otherwise indicated.
   1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 641/A 641M, Class 1 coating.
   2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.

B. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
   1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls, unless otherwise indicated.
   2. Tie Section for Steel Frame: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.188-inch- diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls, unless otherwise indicated.

C. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins, unless otherwise indicated.
   1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

D. Stone Anchors: Fabricate dowels, cramps, and other stone anchors from stainless steel.

E. Adjustable Masonry-Veneer Anchors
   1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
      a. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
   2. Contractor's Option: Unless otherwise indicated, provide any of the following types of anchors:
   3. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
      a. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, 2-3/4 inches wide by 3 inches high; with projecting tabs having slotted holes for inserting vertical legs of wire tie specially formed to fit anchor section.
      b. Anchor Section: Sheet metal plate, 1-1/4 inches wide by 6 inches long, with screw holes top and bottom and with raised rib-stiffened strap, 5/8 inch wide by 3-5/8 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie.
      c. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches wide by 6 inches long, with screw holes top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation or sheathing; and raised rib-stiffened strap, 5/8 inch wide by 6 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.
      d. Anchor Section: Zinc-alloy barrel section with flanged head with eye and corrosion-resistant, self-drilling screw. Eye designed to receive wire tie and to serve as head for drilling fastener into framing. Barrel length to suit sheathing thickness, allowing screw to seat directly against framing with flanged head covering hole in sheathing.
      e. Fabricate sheet metal anchor sections and other sheet metal parts from 0.067-inch- thick, steel sheet, galvanized after fabrication 0.078-inch- thick,.
      f. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.25-inch-diameter, hot-dip galvanized steel wire.
   4. Available Products:
      a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 213 or D/A 210 with D/A 700-708.
      b. Heckmann Building Products Inc.; 315-D with 316 or Pos-I-Tie.
      c. Hohmann & Barnard, Inc.; DW-10 DW-10HS or DW-10-X.

d. Wire-Bond; 1004, Type III or RJ-711.

## 2.9 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing where flashing is exposed or partly exposed and where indicated, complying with Division 07 Section "Sheet Metal Flashing and Trim".

B. Cavity Wall Flashing

1. Metal Sub Flashing with integral Drip Edge: Provide continuous under Flexible Flashing. Fabricate from stainless steel. Extend at least 3 inches into wall inner wythe CMU backup and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
   a. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch thick.
   b. Metal Flashing Terminations: Fabricate from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 3/8 inch to form a stop for retaining sealant backer rod.
2. Flexible Flashing: For flashing not exposed to the exterior, use one of the following, unless otherwise indicated:
   a. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than **0.040 inch**.
      1) Available Products:
         a) Advanced Building Products Inc.; Peel-N-Seal.
         b) Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
         c) Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Barrier-44.
         d) Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.
         e) Heckmann Building Products Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
         f) Henry Company: Blueskin TWF
         g) Hohmann & Barnard, Inc.; Textroflash.
         h) Polyguard Products, Inc.; Polyguard 300.
         i) Polytite Manufacturing Corp.; Poly-Barrier Self-Adhering Wall Flashing.
         j) Williams Products, Inc.; Everlastic MF-40.
   b. Provide mechanically fastened stainless steel termination bar with continuous sealant at top.

## 2.10 MISCELLANEOUS MASONRY ACCESSORIES

A. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

B. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

C. Weep/Vent Products: Use the following, unless otherwise indicated:

1. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.
   a. Provide at 32" o.c. unless otherwise noted.

D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Provide one of the following configurations:
   a. Strips, full-depth of cavity and 10 inches wide, with dovetail shaped notches 7 inches deep that prevent mesh from being clogged with mortar droppings.
2. Available Products:

a. Advanced Building Products Inc.; Mortar Break II.
b. Archovations, Inc.; CavClear Masonry Mat.
c. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop.
d. Mortar Net USA, Ltd.; Mortar Net.
e. Hohmann & Barnard, Inc.

## 2.11 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
1. Available Manufacturers:
a. Diedrich Technologies, Inc.
b. EaCo Chem, Inc.
c. ProSoCo, Inc.

## 2.12 SOURCE QUALITY CONTROL

A. Clay Masonry Unit Test: For each type of unit furnished, per ASTM C 67.
B. Concrete Masonry Unit Test: For each type of unit furnished, per ASTM C 140.
C. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.
D. Prism Test: For each type of construction provided, per ASTM C 1314 UBC Standard 21-17 at 28 days.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
B. Build chases and recesses to accommodate items specified in this and other Sections.
C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
1. Mix units from several pallets or cubes as they are placed.
F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

H. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
   1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
   2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
   3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
   4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch , with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
   5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
   6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.
   7. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

## 3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in **one-third running bond for Brick and running bond for CMU (all types)**; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
E. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.
F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
G. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
H. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
   1. Install compressible filler in joint between top of partition and underside of structure above.
   2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors **48 inches** o.c., unless otherwise indicated.
   3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
   4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 07 Section "Fire-Resistive Joint Systems."

## 3.4 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:
   1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for **2.67 sq. ft.** of wall area spaced not to exceed **16 inches** o.c. horizontally and 16

inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.

a. Where bed joints of wythes do not align, use adjustable (two-piece) type ties.
b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type ties to allow for differential movement regardless of whether bed joints align.

2. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
   a. Where bed joints of both wythes align, use Truss type reinforcement extending across both wythes
   b. Where bed joints of wythes do not align, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

C. Coat cavity face of backup wythe to comply with Division 07 Section "Bituminous Dampproofing."

## 3.5 INSTALLATION OF CAVITY WALL INSULATION: RIGID

A. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
   1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry. Tape joints.

## 3.6 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
   1. Space reinforcement not more than 16 inches o.c.

Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.

   a. Reinforcement above is in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

## 3.7 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
   1. Provide an open space not less than **1/2 inch** in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar and other rigid materials.
   2. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
   3. Space anchors as indicated, but not more than 24 inches o.c. vertically and horizontally.

## 3.8 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing concrete and masonry backup with seismic masonry-veneer anchors to comply with the following requirements:

## 3.9 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry as follows:
   1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
   2. Install preformed control-joint gaskets designed to fit standard sash block.
   3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
   4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
   5. Where control joints extend from window or door head lintels and shelf angles, install bond breaker of building felt in horizontal joint below lintel and rake horizontal joint at lintel for installation of sealant.

C. Form expansion joints in brick made from clay or shale as follows:
   1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches (100 mm) in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
   2. Build flanges of factory-fabricated, expansion-joint units into masonry.
   3. Build in compressible joint fillers where indicated.
   4. Form open joint full depth of brick wythe and of width indicated, but not less than **3/8 inch** for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants."

## 3.10 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

## 3.11 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows, unless otherwise indicated:
   1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
   2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of **8 inches**, and through inner wythe to within 1/2 inch of the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches on interior face.

3. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of **8 inches**, and 1-1/2 inches into the inner wythe.
4. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under building paper or building wrap, lapping at least 4 inches.
5. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
6. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
7. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
8. Install metal sub flashing and integral drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to metal for the entire length.
9. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
10. Install flexible flashing with continuous stainless steel termination bar with continuous sealant at top.

C. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.

D. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products.

## 3.12 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

## 3.13 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports:
1. Payment for these services may be made by Owner.
2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

B. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.
1. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.

C. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.If retaining paragraph below, select either or both tests listed; insert others if required. Testing for mortar air content is especially desirable for reinforced masonry. Testing for compressive strength is desirable if the property specification for mortar is used.

## 3.14 SPECIAL INSPECTIONS

A. Special Inspections and tests shall be performed by the Special Inspector or Special Inspection Agency.
B. Preconstruction Testing: Perform preconstruction testing as follows:
   1. Concrete Masonry Unit Test: For each type of unit required, according to ASTM C 140 for compressive strength.
   2. Mortar Test (Property Specification): For each mix required, according to ASTM C 780 for compressive strength.
   3. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.
C. Construction Testing: Perform construction testing as follows:
   1. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
   2. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
   3. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for compressive strength.
   4. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
D. Verification and inspection of masonry construction shall be Level 1 in accordance with Table 1704.5.1 of North Carolina State Building Code 2018 and as follows:
   1. Perform periodic inspections of the installed masonry construction to verify compliance with the details shown on the construction documents such as use of proper mortar and grout, construction of mortar joints, size, location, spacing and lapping of reinforcing steel, installation of anchors into masonry construction.
   2. Perform continuous inspections during grout placement to verify use of proper grout mix, locations of grout, cleanliness of grout spaces, cleanouts as required and proper consolidation of grout.
      a. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
      b. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
      c. Place grout only after inspectors have verified proportions of site-prepared grout.
E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
F. Additional testing performed to determine compliance of corrected work with specified requirements shall be at Contractor’s expense.

## 3.15 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
   3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
   4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.

5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
8. Clean stone trim to comply with stone supplier's written instructions.
9. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

## 3.16 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
   1. Crush masonry waste to less than 4 inches in each dimension.
   2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 31 Section "Earth Moving."
   3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

**END OF SECTION 04 20 00**

**SECTION 04 72 00 – CAST STONE**

PART 1 - General

### 1.1. Section Includes - Architectural Cast Stone.

Scope - Cast Stone shown on architectural drawings and as described in this specification.

- Manufacturer shall furnish Cast Stone covered by this specification.

### 1.2. Related Sections

Section – 01 33 00 – Submittal Procedures.

Section – 04 05 13 – Masonry Mortaring.

Section – 04 05 16 – Masonry Grouting.

Section – 04 05 19 – Masonry Anchorage and Reinforcing. Section – 04 20

20 – Unit Masonry.

Section – 07 90 00 – Joint Protection.

### 1.3. References

ACI 318 – Building Code Requirements for Reinforced Concrete.

ASTM A615/A615M – Standard Specification for Deformed and Plain Billet-Steel Bars for Reinforced Concrete.

ASTM A1064 / A1064M – Standard Specification for Carbon Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

ASTM C33 – Standard Specification for Concrete Aggregates.

ASTM C150 – Standard Specification for Portland Cement.

ASTM C595/C595M – Specification for Blended Hydraulic Cements

ASTM C1157/C1157M – Performance Specification for Hydraulic Cement

ASTM C173 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volume Method.

ASTM C231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

ASTM C260 – Standard Specification for Air-Entrained Admixtures for Concrete.

ASTM C270 – Standard Specification for Mortar for Unit Masonry.

ASTM C426 – Standard Test Method for Linear Shrinkage of Concrete Masonry Units. ASTM

C494/C494M – Standard Specification for Chemical Admixtures for Concrete.

ASTM C618 – Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as aMineral Admixture in Concrete.

ASTM C666/666M – Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.

ASTM C979 – Standard Specification for Coloring Pigments for Integrally Colored Concrete.

ASTM C989 – Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete.

ASTM C1116 – Standard Specification for Fiber Reinforced Concrete and Shotcrete.

ASTM C1194 – Standard Test Method for Compressive Strength of Architectural Cast Stone.

ASTM C1195 – Standard Test Method for Absorption of Architectural Cast Stone.

ASTM C1364 – Standard Specification for Architectural Cast Stone.

ASTM D1729 – Practice for Visual Appraisal of Colors and Color Differences of Diffusely-Illuminated Opaque Materials.

ASTM D2244 – Standard Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.

ASTM D7957/D7957M – Standard Specification for Solid Round Glass Fiber Reinforced Polymer Bars for Concrete Reinforcement

TMS 404-504-604 – Standards for Architectural Cast Stone Design – Fabrication - Installation

### 1.4. Definitions

Cast Stone - a refined architectural concrete building unit manufactured to simulate natural cut stone, used in Division 4 masonry applications.

- Dry Cast – manufactured from zero slump concrete.

Vibrant Dry Tamp (VDT) casting method: Vibratory ramming of earth moist, zero-slump concrete against a rigid mold until it is densely compacted.

Machine casting method: Manufactured from earth moist, zero-slump concrete compacted by machinery using vibration and pressure against a mold until it becomes densely consolidated.

- Wet Cast – Manufactured from measurable slump concrete.

Wet casting method: Manufactured from measurable slump concrete and vibrated into a mold until it becomes densely consolidated.

- Specifier Note: Slump, manufacturing method, and apparatus shall be selected by the manufacturer and not specified by the purchaser.

### 1.5. Submittal Procedures

Comply with Section 01 33 00 – Submittal Procedures.

Samples: Submit pieces of the Cast Stone that are representative of the general range of finish and color proposed to be furnished for the project.

Test results: Submit manufacturers test results of Cast Stone previously made by the manufacturer. Shop Drawings: Submit manufacturers shop drawings including profiles, cross-sections, reinforcement, exposed faces, arrangement of joints (optional for standard or semi-custom installations), anchoring methods, anchors (if required), annotation of stone types and their location.

Warranty: Submit Cast Stone Institute® Member Limited Warranty.

Certification: Submit valid Cast Stone Institute® Plant Certification.

### 1.6. Quality Assurance

Manufacturer Qualifications:

- Cast Stone shall be produced by one of the following but not limited to:
  - Motsinger Precast Products (336) 764-0350
  - A&D Precast (704) 483-4836
  - Greenbrier Precast Concrete (336) 238-9090
- Manufacturer shall have sufficient plant facilities to produce the shapes, quantities and size of Cast Stone required in accordance with the project schedule.

Standards: Comply with the requirements of the Cast Stone Institute® Technical Manual and the project specifications. Where a conflict may occur, the contract documents shall prevail.

Mock-up (Optional) Provide full size unit(s) for use in construction of sample wall. The approved mock-up shall become the standard for appearance and workmanship for the project.

Warranty Period: 10 years.

PART 2 - Products

### 2.1. Architectural Cast Stone

Comply with current version ASTM C1364 Physical properties: Provide the following:

- Compressive Strength - ASTM C1194: 6,500 psi minimum at 28 days.
- Absorption – ASTM C1195: 6.0% maximum at 28 days.
- Air Content – Provide sufficient air content to meet the freeze-thaw requirements for wet cast products, when the air content is tested in accordance with Test Method C173/C173M or Test Method C231/C231M. Air entrainment is not required for Vibrant Dry Tamp (VDT) products.
- Freeze-thaw – ASTM C666/C666M in accordance with ASTM C1364. The CPWL shall be less than 5.0% after 300 cycles of freezing and thawing.
- Linear Drying Shrinkage – ASTM C426: Test and report in accordance with ASTM C1364.

Job site testing – One sample from production units may be selected at random from the field for each 500 cubic feet (14 m 3) delivered to the job site.

- Three field cut cube specimens from each of these samples shall have an average minimum compressive strength of not less than 85% with no single specimen testing less than 75% of design strength as allowed by ACI 318.

- Three field cut cube specimens from each of these samples shall have an average maximum cold-water absorption of 6.0%.

- Field specimens shall be tested in accordance with ASTM C1194 and C1195.

### 2.2. Raw Materials

Portland cement – Type I or Type III, white and/or grey, ASTM C150 or ASTM C595 Blended Hydraulic Cement (Type 1L).

Coarse aggregates - Granite, quartz or limestone, ASTM C33, except for gradation, and are optional for the Vibrant Dry Tamp (VDT) casting method.

Fine aggregates - Manufactured or natural sands, ASTM C33, except for gradation.

Colors - Inorganic iron oxide pigments, ASTM C979 except that carbon black pigments shall not be used.

Admixtures - Comply with the following:

- ASTM C260 for air-entraining admixtures.

- ASTM C494/C495M Types A - G for water reducing, retarding, accelerating, and high range admixtures.

- Other admixtures: Integral water repellents and other chemicals, for which no ASTM Standard exists, shall be previously established as suitable for use in concrete by proven field performance or through laboratory testing.

- ASTM C618 mineral admixtures of dark and variable colors shall not be used in surfaces intended to be exposed to view.

- ASTM C989 granulated blast furnace slag may be used to improve physical properties. Tests are required to verify these features.

Water – Potable Reinforcing bars:

- ASTM A615/A615M: Grade 40 or 60.
- ASTM D7957/D7957M: Standard Specification for Solid Round Glass Fiber Reinforced Polymer Bars for Concrete Reinforcement

- Welded Wire Fabric: ASTM A1064 / A1064M where applicable for wet cast units.

- F iber reinforcement (optional): ASTM C1116

All anchors, dowels and other anchoring devices and shims shall be standard building stone anchors commercially available in a non-corrosive material such as zinc plated, galvanized steel, brass, or stainless steel Type 302, 304 or 316.

### 2.3. Color And Finish

Match sample on file in architect's office.

All surfaces intended to be exposed to view shall have a fine-grained texture similar to natural stone, with no air voids in excess of 1/32 in. and the density of such voids shall be le ss than 3 occurrences per any 1 $in.^2$ and not obvious under direct daylight illumination at a 5 ft distance.

Units shall exhibit a texture approximately equal to the approved sample when viewed under direct daylight illumination at a 10 ft distance.

- ASTM D2244 permissible variation in color between units of comparable age subjected to similar weathering exposure.
    - Total color difference – not greater than 6 units.
    - Total hue difference – not greater than 2 units.

Minor chipping resulting from shipment and delivery shall not be grounds for rejection. Minor chips shall not be obvious under direct daylight illumination from a 20-ft distance.

The occurrence of crazing or efflorescence shall not constitute a cause for rejection. Remove cement film, if required, from exposed surfaces prior to packaging for shipment.

### 2.4. Reinforcing

Reinforce the units as required by the drawings and for safe handling and structural

stress. Minimum reinforcing shall be 0.25 percent of the cross section area.

Reinforcement shall be noncorrosive where faces exposed to weather are covered with less than 1.5 in. of concrete material. All reinforcement shall have minimum coverage of twice the diameter of the bars.

Panels, soffits and similar stones greater than 24 in. (600 mm) in one direction shall be reinforced in that direction. Units less than 24 in. (600 mm) in both their length and width dimension shall be non-reinforced unless otherwise specified.

Welded wire fabric reinforcing shall not be used in dry cast products.

### 2.5. Curing

Cure units in a warm curing chamber approximately 100ºF (37.8ºC) at 95 percent relative humidity for approximately 12 hours, or cure in a 95 percent moist environment at a minimum 70ºF (21.1ºC) for 16 hours after casting. Additional yard curing at 95 percent relative humidity shall be 350 degree- days (i.e. 7 days @ 50°F (10°C) or 5 days @ 70°F (21°C)) prior to shipping. Form cured units shall be protected from moisture evaporation with curing blankets or curing compounds after casting.

### 2.6. Manufacturing Tolerances

Minimum Thickness shall be 2.5" to facilitate testing for compressive strength and absorption as specified in ASTM C-1364 Standard Specification for Architectural Cast Stone.

Cross section dimensions shall not deviate by more than ±1/8 in. from approved dimensions.

Length of units shall not deviate by more than length/ 360 or ±1/8 in., whichever is greater, not to exceed ±1/4 in.

Maximum length of any unit shall not exceed 15 times the average thickness of such unit unless otherwise agreed by the manufacturer.

Warp, bow or twist of units shall not exceed length/ 360 or ±1/8 in., whichever is greater.

Location of dowel holes, anchor slots, flashing grooves, false joints and similar features – On formed sides of unit, 1/8 in., on unformed sides of unit, 3/8 in. maximum deviation.

### 2.7. Production Quality Control

Testing:

- Test compressive strength and absorption from specimens taken from every 500 cubic feet of product produced.
- Perform tests in accordance ASTM C1194 and C1195.
- Have tests performed by an independent testing laboratory every six months.
- New and existing mix designs shall be tested for strength and absorption compliance prior to producing units.
- Retain copies of all test reports for a minimum of two years.

### 2.8. Delivery, Storage And Handling

Mark production units with the identification marks as shown on the shop drawings. Package units and protect them from staining or damage during shipping and storage. Provide an itemized list of product to support the bill of lading.

## Part 3 Execution

### 3.1. Examination

Installing contractor shall check Cast Stone materials for fit and finish prior to installation.

Unacceptable units shall not be set.

### 3.2. Setting Tolerances

Comply with Cast Stone Institute® Technical Manual.

Set stones 1/8 in. or less, within the plane of adjacent

units. Joints, plus - 1/16 in., minus - 1/8 in.

### 3.3. Jointing

Joint size:

- At stone/brick joints 3/8 in.
- At stone/stone joints in vertical position 1/4 in. (3/8 in. optional).
- Stone/stone joints exposed on top 3/8 in.

Joint materials:

- Mortar, Type N, ASTM C270.
- Use a full bed of mortar at all bed joints.
- Flush vertical joints full with mortar.
- Leave all joints with exposed tops or under relieving angles open for sealant.
- Leave head joints in copings and projecting components open for sealant.

Location of joints:

- As shown on shop drawings.
- At control and expansion joints unless otherwise shown.

### 3.4. Setting

Drench units with clean water prior to setting.

Fill dowel holes and anchor slots completely with mortar or non-shrink

grout. Set units in full bed of mortar, unless otherwise detailed.

Rake mortar joints 3/4 in. in for pointing.

Remove excess mortar from unit faces immediately after

setting. Tuck point unit joints to a slight concave profile.

### 3.5. Joint Protection

Comply with requirements of Section 07 90 00.

Prime ends of units, insert properly sized backing rod and install required sealant.

### 3.6. Repair and Cleaning

Repair chips with touchup materials furnished by manufacturer.

Saturate units to be cleaned prior to applying an approved masonry cleaner. Consult with the manufacture for appropriate cleaners.

### 3.7. Inspection and Acceptance

Inspect finished installation according to Cast Stone Institute® Technical Bulletin #36.

Do not field apply water repellent until repair, cleaning, inspection and acceptance is completed.

### 3.8. Water Repellent (Optional)

Apply water repellent in accordance with Cast Stone Institute® Technical Bulletin #35 or water repellent manufacturer's directions.

# SECTION 051200 - STRUCTURAL STEEL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

A. This Section includes the following:

1. Structural steel.
2. Architecturally exposed structural steel.
3. Grout.

## 1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

B. Architecturally Exposed Structural Steel: Structural steel designated as architecturally exposed structural steel in the Contract Documents.

## 1.4 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand LRFD loads indicated and comply with other information and restrictions indicated.

## 1.5 SUBMITTALS

A. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
5. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealedby the qualified professional engineer responsible for their preparation.

B. Welding certificates.

C. Source quality-control test reports.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

B. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
3. AISC's "Load and Resistance Factor Design Specification for Structural Steel Buildings."
4. AISC's "Specification for the Design of Steel Hollow Structural Sections."
5. AISC's " Specification for Load and Resistance Factor Design of Single-Angle Members."
6. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.8 COORDINATION

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M Grade 50.

B. Channels, Angles: ASTM A 36/A 36M.

C. Plate and Bar: ASTM A 36/A 36M.

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

E. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563heavy hex carbon-steel nuts; and ASTM F 436hardened carbon-steel washers.

1. Finish: Plain.

B. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

1. Nuts: ASTM A 563hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436 hardened carbon steel.
4. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

C. Threaded Rods: ASTM A 307, Grade A.

1. Nuts: ASTM A 563hex carbon steel.
2. Washers: ASTM F 436 carbon steel.
3. Finish: Hot-dip zinc coating.

2.3 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

2.4 GROUT

A. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404, Size No. 2. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

B. Metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.

C. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Load and Resistance Factor Design Specification for Structural Steel Buildings."

1. Camber structural-steel members where indicated.
2. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
3. Mark and match-mark materials for field assembly.
4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Architecturally Exposed Structural Steel: Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel identified as architecturally exposed structural steel.

1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, and roughness.
2. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.

C. 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.

D. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

## 2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances.

    a. Grind butt welds flush.
    b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

## 2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials.
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

## 2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.

1. Fill vent holes and grind smooth after galvanizing.
2. Galvanize lintels attached to structural-steel frame and located in exterior walls.

## 2.9 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, 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.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Load and Resistance Factor Design Specification for Structural Steel Buildings."

B. Base Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base plates. Clean bottom surface of base plates.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Load and Resistance Factor Design Specification for Structural Steel Buildings" for bearing, adequacy of temporary connections, alignment, 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 will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances.

a. Grind butt welds flush.
b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds.

B. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.

1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E 165.
b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
c. Ultrasonic Inspection: ASTM E 164.
d. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, and abutting structural steel.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 9 painting Sections.

END OF SECTION 051200

# SECTION 052100 - STEEL JOIST 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.

B. Division 1 Section "LEEDS Requirements" for recycled content and regional materials.

### 1.2 SUMMARY

A. This Section includes the following:

1. K-series steel joists.
2. K-series steel joist substitutes.
3. Long-span steel joists.
4. Joist accessories.

### 1.3 DEFINITIONS

A. SJI "Specifications" : Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

### 1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.

B. Design special joists to withstand design loads with live load deflections no greater than the following:
1. Roof Joists: Vertical deflection of 1/360 of the span.

### 1.5 SUBMITTALS

A. Product Data: For each type of joist, accessory, and product indicated.

B. Shop Drawings: Show layout, designation, number, type, location, and spacings of joists. Include joining and anchorage details, bracing, bridging, joist accessories; splice and connection locations and details; and attachments to other construction.

1. Indicate locations and details of bearing plates to be embedded in other construction.
2. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

C. Welding certificates.

D. Manufacturer Certificates: Signed by manufacturers certifying that joists comply with requirements.

E. Mill Certificates: Signed by bolt manufacturers certifying that bolts comply with requirements.

F. Qualification Data: For manufacturer.

G. Field quality-control test and inspection reports.

H. Research/Evaluation Reports: For joists.

## 1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables of SJI "Specifications."

1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

B. SJI Specifications: Comply with standard specifications in SJI's "Specifications" that are applicable to types of joists indicated.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

## 1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

# PART 2 - PRODUCTS

## 2.1 MATERIALS

A. Steel: Comply with SJI's "Specifications" for web and steel-angle chord members.

B. Steel Bearing Plates: ASTM A 36/A 36M.

C. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A, carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.

1. Finish: Plain, uncoated.

D. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563heavy hex carbon-steel nuts; and ASTM F 436hardened carbon-steel washers.

1. Finish: Plain.

E. Welding Electrodes: Comply with AWS standards.

F. Galvanizing Repair Paint: ASTM A 780.

## 2.2 PRIMERS

A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

B. Primer: Provide shop primer that complies with Division 09 painting Sections.

## 2.3 K-SERIES STEEL JOISTS

A. Manufacture steel joists of type indicated according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.

1. Joist Type: K-series steel joists.

B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.

C. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

D. Provide holes in chord members for connecting and securing other construction to joists.

E. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."

F. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."

G. Do not camber joists.

H. Camber joists according to SJI's "Specifications.".

I. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

## 2.4 LONG-SPAN STEEL JOISTS

A. Manufacture steel joists according to "Standard Specifications for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as indicated.

B. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

C. Provide holes in chord members for connecting and securing other construction to joists.

D. Camber long-span steel joists according to SJI's "Specifications."

E. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

## 2.5 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Fabricate steel bearing plates with integral anchorages of sizes and thicknesses indicated. Shop prime paint.

C. Steel bearing plates with integral anchorages are specified in Division 05 Section "Metal Fabrications."

D. Supply ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inchof finished wall surface, unless otherwise indicated.

E. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

## 2.6 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.

C. Apply 1 coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 milthick.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads have been applied.

C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework using carbon-steel bolts.

E. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.

F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

## 3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect connections and to perform field tests and inspections and prepare test and inspection reports.

B. Field welds will be visually inspected according to AWS D1.1/D1.1M.

C. In addition to visual inspection, field welds will be tested according to AWS D1.1/D1.1M and the following procedures, as applicable:

1. Radiographic Testing: ASTM E 94.
2. Magnetic Particle Inspection: ASTM E 709.
3. Ultrasonic Testing: ASTM E 164.
4. Liquid Penetrant Inspection: ASTM E 165.

D. Bolted connections will be visually inspected.

E. High-strength, field-bolted connections will be tested and verified according to procedures in RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts."

F. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.

G. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.4 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories.

1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

D. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION

# SECTION 053100 - STEEL DECK

## 1.1 RELATED DOCUMENTS

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

B. Division 1 Section "LEEDS Requirements" for recycled content and regional materials.

## 1.2 SUMMARY

A. This Section includes the following:

1. Roof deck.
2. Composite floor deck.

## 1.3 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

C. Product Certificates: For each type of steel deck, signed by product manufacturer.

D. Welding certificates.

E. Field quality-control test and inspection reports.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

1. Power-actuated mechanical fasteners.

G. Research/Evaluation Reports: For steel deck.

## 1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.

B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

C. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

D. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

E. FMG Listing: Provide steel roof deck evaluated by FMG and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

# PART 2 - PRODUCTS

## 2.1 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:

1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer. Use painted deck at all exposed roof deck locations.

a. Color: Manufacturer's standard.

2. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating. Use galvanized deck at all non-exposed roof deck locations.
3. Deck Profile: As indicated.
4. Profile Depth: As indicated.
5. Design Uncoated-Steel Thickness: As indicated.
6. Span Condition: As indicated.
7. Side Laps: Overlapped or interlocking seam at Contractor's option.

## 2.2 COMPOSITE FLOOR DECK

A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:

1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60zinc coating.
2. Profile Depth: As indicated.
3. Design Uncoated-Steel Thickness: As indicated.
4. Span Condition: As indicated.

## 2.3 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inchdesign uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 30 for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

I. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inchthick, of same material and finish as deck, with 3-inch-wide flanges and sloped recessed pans of 1-1/2-inchminimum depth. For drains, cut holes in the field.

J. Flat Sump Plate: Single-piece steel sheet, 0.0747 inchthick, of same material and finish as deck. For drains, cut holes in the field.

K. Galvanizing Repair Paint: ASTM A.

L. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 incheslong, and as follows:

1. Weld Diameter: 5/8 inch, nominal.
2. Weld Spacing: as indicated.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18 inches, and as follows:

1. Mechanically fasten with self-drilling, No. 10diameter or larger, carbon-steel screws.
2. Fasten with a minimum of 1-1/2-inch-long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped 2 inchesminimum.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 12 inchesapart with at least one weld at each corner.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

G. Sound-Absorbing Insulation: Installation into topside ribs of deck as specified in Division 07.

## 3.4 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: 5/8 inch, nominal.
2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches apart, but not more than 18 inches apart.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches, and as follows:

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws, or
2. Fasten with a minimum of 1-1/2-inch- long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

F. Install piercing hanger tabs at 14 inches apart in both directions, within 9 inches of walls at ends, and not more than 12 inches from walls at sides, unless otherwise indicated.

## 3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

C. Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Division 09.

D. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

# SECTION 054000 - COLD-FORMED METAL FRAMING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Exterior non-load-bearing curtain wall and soffit framing.
2. Interior non-load bearing partition framing.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of cold-formed steel framing product and accessory.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
3. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

### 1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product test reports.

D. Research reports.

### 1.4 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Product Tests: Mill certificates or data from a qualified independent testing agency.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following

1. AllSteel & Gypsum Products, Inc.
2. California Expanded Metal Products Company.
3. ClarkWestern Building Systems, Inc.
4. Consolidated Fabricators Corp.; Building Products Division.
5. Craco Mfg., Inc.
6. Custom Stud Inc.
7. Design Shapes in Steel.
8. Dietrich Metal Framing; a Worthington Industries company.
9. Formetal Co. Inc. (The).
10. MarinoWARE.
11. MBA Building Supplies, Inc.
12. Nuconsteel; a Nucor Company.
13. Olmar Supply, Inc.
14. Quail Run Building Materials, Inc.
15. SCAFCO Corporation.
16. Southeastern Stud & Components, Inc.
17. State Building Products, Inc.
18. Steel Construction Systems.
19. Steel Network, Inc. (The).
20. Steel Structural Systems.
21. Steeler, Inc.
22. Super Stud Building Products, Inc.
23. Telling Industries, LLC.
24. United Metal Products, Inc.
25. United Steel Manufacturing.

### 2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
   1. Design Loads: NC Building Code
   2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
      a. Exterior non-load bearing framing: Horizontal deflection of 1/600 of the wall height
      b. Interior non-load bearing partition framing: Horizontal deflection of 1/360 of the wall height

B. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.

2.3 COLD-FORMED STEEL FRAMING, GENERAL

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: As required by structural performance
2. Coating: G90

B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: G90.

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch
2. Flange Width: 1-5/8 inches

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and matching minimum base-metal thickness of steel studs.

C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

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. AllSteel & Gypsum Products, Inc.
b. ClarkWestern Building Systems, Inc.
c. Dietrich Metal Framing; a Worthington Industries company.
d. MarinoWARE.
e. SCAFCO Corporation.
f. Steel Network, Inc. (The).

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration.

## 2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36 or Grade 55

C. Expansion Anchors: Fabricated from corrosion-resistant materials, 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 per ASTM E 488 conducted by a qualified testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

## 2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, non-staining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.

D. Shims: Load bearing, high-density multi-monomer plastic, and non-leaching; or of cold-formed steel of same grade and coating as framing members supported by shims.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerance and other conditions affecting performance.

3.2 PREPARATION

A. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

D. Install framing members in one-piece lengths.

E. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

F. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

G. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

H. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

I. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As required by design, 16 inches

C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
   1. Connect vertical deflection clips to infill studs and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

   1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
   2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
   3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

## 3.5 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

## 3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

# SECTION 05 50 00 - METAL FABRICATIONS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:
   1. Steel framing and supports for overhead doors.
   2. Steel framing and supports for countertops.
   3. Steel framing and supports for mechanical and electrical equipment.
   4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   5. Shelf angles.
   6. Loose bearing and leveling plates.
   7. Steel weld plates and angles for casting into concrete not specified in other Sections.
   8. Miscellaneous steel trim.
   9. Fabricated Equipment

B. Products furnished, but not installed, under this Section include the following:
   1. Loose steel lintels.
   2. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

C. Related Sections include the following:
   1. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.
   2. Division 04 Section "Unit Masonry" for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.
   3. Division 05 Section "Structural Steel."
   4. Division 06 Section "**Rough Carpentry**" for metal framing anchors.
   5. Division 06 Section "**Interior Architectural Woodwork**" for perforated panels.

### 1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

B. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

### 1.4 SUBMITTALS

A. Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Paint products.
3. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.
1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.
3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

D. Welding certificates.

E. Qualification Data: For professional engineer.

## 1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.6, "Structural Welding Code--Stainless Steel."

## 1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

## 1.7 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

# 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 Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

## 2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

## 2.3 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
C. Steel Tubing: ASTM A 500, cold-formed steel tubing. For exterior installations and where indicated, provide tubing with hot dip galvanized coating per ASTM A 53.
D. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads. Black finish unless otherwise indicated. Galvanized finish for exterior installations and where indicated.
E. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.

## 2.4 NONFERROUS METALS

A. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.
B. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.

## 2.5 FASTENERS

A. General: Unless otherwise indicated, provide Type **316** stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
C. Anchor Bolts: ASTM F 1554, Grade 36.
   1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
D. Eyebolts: ASTM A 489.
E. Machine Screws: ASME B18.6.3.
F. Lag Bolts: ASME B18.2.1.
G. Wood Screws: Flat head, ASME B18.6.1.
H. Plain Washers: Round, ASME B18.22.1.
I. Lock Washers: Helical, spring type, ASME B18.21.1.
J. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
   1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.
K. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when

installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material for Anchors in Exterior Locations: Alloy Group [**1**] [**2**] stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

## 2.6 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
B. Shop Primers: Provide primers that comply with Division 09 **painting Sections.**
C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
   1. Use primer with a VOC content of **[420 g/L (3.5 lb/gal.)] <Insert VOC limit>** or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Products:
      a. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.
      b. Carboline Company; Carbozinc 621.
      c. ICI Devoe Coatings; Catha-Coat 313.
      d. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.
      e. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
      f. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
      g. Tnemec Company, Inc.; Tneme-Zinc 90-97.
D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
F. Concrete Materials and Properties: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

## 2.7 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
E. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.
G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

## 2.8 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts if units are installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

## 2.9 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

## 2.10 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles located in exterior walls.

## 2.11 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates after fabrication.

2.12 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.13 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
   1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
C. Galvanize exterior miscellaneous steel trim and interior miscellaneous steel trim, where indicated.

2.14 FABRICATED EQUIPMENT

A. Materials:
   1. Stainless Steel: ASTM A 666, with No. 4 finish (directional satin finish) on exposed surfaces.
      a. Provide self-adhesive protective paper covering on polished surfaces of stainless steel sheet work, and retain/maintain until time of final testing, cleaning, start-up, and substantial completion.
   2. Galvanized Steel: ASTM A 653/A 653M, G90 coating designation; commercial-quality, cold-rolled steel that is zinc coated by the hot-dip process and chemically treated.
   3. Stainless Steel Tube: ASTM A 554, Type 304 with No. 4 polished finish.
   4. Sound Deadening: Heavy-bodied resinous coating, filled with granulated cork or other resilient material, compounded for permanent, non-flaking adhesion to metal in 1/8" thick coating.
      a. Apply coating of sound deadening material to underside of tops, drainboards, dish tables, and sinks.
   5. Sealants: ASTM C 920; Type S Grade NS, Class 25, Use NT. Provide sealant that when fully cured and washed meets requirements of Food and Drug Administration Regulation 21 CFR 177.2600 for use in areas where it comes in contact with food.
      a. Color: As selected by Architect from manufacturer's standard colors.
      b. Backer Rod: Closed-cell polyethylene rod stock, larger than joint width.
   6. Gaskets: Solid or hollow (not cellular) neoprene or PVC; light gray, minimum 40 Shore A hardness, self-adhesive or prepared for either adhesive application or mechanical anchorage.
B. Tops: Fabricate of 14-ga stainless steel, with exposed edges rolled on 1-1/2" diameter radius, and with corners bullnosed. Where tops are adjacent to walls or adjoining equipment, turn up 6" and back 1" on 45 angle unless otherwise indicated.
   1. Backsplashes: Cove horizontal and vertical corners.
C. Framing: Mount tops on 1-1/2" x 1-1/2" x 1/8" galvanized angle iron, or 4" wide galvanized channels.
   1. Run framework around entire perimeter of unit, and cross brace on 30" centers. Fasten framing to underside of top surfaces with 1/4" studs welded at approximately 12" centers. Provide each stud with suitable chrome-plated lockwashers and capnuts, and make stud lengths such that cap nuts can be made up tight bringing top down snugly to framing.
D. Legs and Cross Rails: Construct legs of 1-5/8" OD x 16-ga stainless steel tubing, with fully enclosed stainless steel bullet shaped adjustable foot with minimum adjustment of 1" up or down without any threads showing. Fasten legs to 4" high stainless steel gusset with top completely sealed by means of stainless steel plate. Weld gusset continuously to bottom of unit framing.
E. Shelves: Construct of 14-ga stainless steel.
   1. Bottom Shelves: Extend forward and turn down at front so as to be flush with front facing of cabinet.

2. Fixed Intermediate Shelves: Weld to front stiles and to 14-ga stainless steel brackets so that shelve is 1" away from back and ends of cabinet.
3. Adjustable Shelves: Channel on all 4 sides, weld corners, and mount on removable stainless steel standards.

F. Open Base Shelving: Construct of 14-ga stainless steel with edges rolled down on open sides, and 2" turn up with 3/4" radius on rear and ends where adjacent to walls and other equipment. Neatly notch corners and weld to legs. Reinforce shelving longitudinally with 14-ga formed channel welded to underside. Construct removable shelves as above, but fit over cross rails. Do not exceed shelving sections of 30" long; where one section abuts another, turn down edges 1".

G. Wall Shelves: Construct of 14-ga stainless steel with 1-1/2" roll on front and exposed ends, and with 2" turn up on back and ends where adjacent to walls or other fixtures. Weld all corners. Construct wall brackets of 14-ga stainless steel with 1-1/2" flange at wall and completely welded to underside of shelf. Fasten each bracket to wall with minimum of two, 1/2" bolts anchored to wall. Fasten shelf to wall bracket by means of studs welded to shelf, and secure with lockwasher and chrome-plated cap nuts. Install so that shelf sets 1-1/2" away from wall.

## 2.15 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

## 2.16 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
1. Exteriors (SSPC Zone 1B) **and Items Indicated to Receive Zinc-Rich Primer**: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

D. Stripe paint corners, crevices, bolts, welds, and sharp edges.

E. Powder Coating: Powder Coat items as indicated to comply with applicable standard listed below: ASTM D3451 – 06 (2012)
1. D2967-07(2013) Standard Test Method for Corner Coverage of Powder Coatings
2. D3451-06(2012) Standard Guide for Testing Coating Powders and Powder Coatings
3. D4217-07(2013) Standard Test Method for Gel Time of Thermosetting Coating Powder
4. D4242-07(2013) Standard Test Method for Inclined Plate Flow for Thermosetting Coating Powders
5. D5382-02(2013) Standard Guide to Evaluation of Optical Properties of Powder Coatings
6. D5861-07(2013) Standard Guide for Significance of Particle Size Measurements of Coating Powders
7. D5965-02(2013) Standard Test Methods for Specific Gravity of Coating Powders
8. D6441-05(2010) Standard Test Methods for Measuring the Hiding Power of Powder Coatings
9. D7378-10 Standard Practice for Measurement of Thickness of Applied Coating Powders to Predict Cured Thickness.

2.17 ALUMINUM FINISHES

A. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
C. Field Welding: Comply with the following requirements:
    1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
    2. Obtain fusion without undercut or overlap.
    3. Remove welding flux immediately.
    4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.
E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
B. Anchor supports for operable partitions securely to and rigidly brace from building structure.
C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
    1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

3.3 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
    1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.

2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.
C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

**END OF SECTION 05 50 00**

# SECTION 06 10 00- ROUGH CARPENTRY

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:
   1. Wood furring, grounds, nailers, and blocking.
   2. Blocking with dimensional lumber.
   3. Plywood backing panels.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 07 “Sheet Metal Flashing and Trim”

### 1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specification Sections.

B. Wood treatment data as follows, including chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated materials:

C. For each type of preservative-treated wood product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.

D. For waterborne-treated products, include statement that moisture content of treated materials was reduced to levels indicated before shipment to Project site.

E. Material test reports from a qualified independent testing agency indicating and interpreting test results relative to compliance of fire-retardant-treated wood products with performance requirements indicated.

F. Warranty of chemical treatment manufacturer for each type of treatment.

### 1.4 DELIVERY, STORAGE, AND HANDLING

A. Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

B. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

A. Lumber Standards: Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.
B. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:
   1. SPIB - Southern Pine Inspection Bureau.
   2. WWPA - Western Wood Products Association.
C. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
D. For exposed lumber, furnish pieces with grade stamps applied to ends or back of each piece.
E. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
F. Provide dressed lumber, S4S, unless otherwise indicated.
G. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.
H. Fire-Retardant-Treated Materials:
   1. General: Where “treated wood” or “pressure treated wood” or other wood blocking or furring located within wall assemblies is indicated comply with the applicable requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL; U, S. Testing; or Timber Products Inspections. Inc. Provide written statement that the fire retardant chemicals used are compatible with materials to which the treated wood is in contact.
I. Treatment Type: Interior Type A for protected wood and Exterior for wood exposed to weather.

2.2 DIMENSION LUMBER

A. General: Provide dimension lumber of grades indicated according to the ALSC National Grading Rule (NGR) provisions of the inspection agency indicated.

2.3 MISCELLANEOUS FRAMING

A. Provide the following grades and species:
   1. Grade: No. 2.
   2. Species: Southern pine; SPIB.

2.4 BOARDS

A. Exposed Boards: Where boards will be exposed in the finished work, provide the following:
   1. Moisture Content: 19 percent maximum.
   2. Species and Grade: Southern pine, C Finish per SPIB rules.
   3. Species and Grade: Spruce-pine-fir, C & Btr per WCLIB rules or C Select per NLGA or WWPA rules.
   4. Species and Grade: Any species above.
B. Concealed Boards: Where boards will be concealed by other work, provide lumber with 19 percent maximum moisture content and of following species and grade:
   1. Species and Grade: Mixed southern pine, No. 2 per SPIB rules.

2. Species and Grade: Spruce-pine-fir, Standard per WCLIB rules or No. 3 Common per WWPA rules.
3. Species and Grade: Any species above.

## 2.5 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction, including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.
B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.
C. Moisture Content: 19 percent maximum for lumber items are not specified to receive wood preservative treatment.
D. Grade: For dimension lumber sizes, provide No. 3 or Standard grade lumber per ALSC's NGRs of any species. For board-size lumber, provide No. 3 Common grade per NELMA, NLGA, or WWPA; No. 2 grade per SPIB; or Standard grade per NLGA, WCLIB or WWPA of any species.

## 2.6 MISCELLANEOUS CONCEALED PANELS

A. APA-rated sheathing, Exposure 1, span rating to suit framing in each location.
B. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant-treated plywood panels with grade, C-D Plugged Exposure 1, in thickness indicated or, if not otherwise indicated, not less than 15/32 inch thick.

## 2.7 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, **fire-retardant treated,** in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

## 2.8 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
B. Where miscellaneous carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of Type 304 stainless steel.
C. Nails, Wire, Brads, and Staples: FS FF-N-105.
D. Power-Driven Fasteners: CABO NER-272.
E. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

## 2.9 METAL FRAMING ANCHORS

A. General: Provide galvanized steel framing anchors of structural capacity, type, and size indicated and acceptable to authorities having jurisdiction.
B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653, G60 coating designation; structural, commercial, or lock-forming quality, as standard with manufacturer for type of anchor indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Discard units of material with defects that impair quality of carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.
B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.
C. Fit carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.
D. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.
E. Securely attach carpentry work as indicated and according to applicable codes and recognized standards.
F. Countersink nail heads on exposed carpentry work and fill holes with wood filler.
G. Use fasteners of appropriate type and length. Predrill members when necessary to avoid splitting wood.

3.2 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

A. Install where shown and where required for screeding or attaching other work. Cut and shape to required size. Coordinate locations with other work involved.
B. Attach to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

3.3 WOOD FURRING

A. Install plumb and level with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

**END OF SECTION 06 10 00**

# SECTION 06 16 00 - SHEATHING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:
   1. Wall sheathing.
   2. Sheathing joint-and-penetration treatment.
   3. Flexible flashing at openings in sheathing.

B. Related Sections include the following:
   1. Division 06 Section "Rough Carpentry" for plywood backing panels.

### 1.3 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

### 1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Fiberboard wall sheathing.

### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

## PART 2 - PRODUCTS

### 2.1 WALL SHEATHING

A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Gypsum.
      b. G-P Gypsum Corporation.
      c. National Gypsum Company.
      d. United States Gypsum Co.

2. Product: Basis of Design - "Dens-Glass Gold" by G-P Gypsum Corporation.
3. Type and Thickness: Type X, 5/8 inch thick.
4. Size: 48 by 120 inches or largest size available for vertical installation.

## 2.2 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
   1. For wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
   1. For steel framing less than 0.0329 inch thick, attach sheathing to comply with ASTM C 1002.
   2. For steel framing from 0.033 to 0.112 inch thick, attach sheathing to comply with ASTM C 954.

## 2.3 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing Board: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated, and complying with requirements for elastomeric sealants specified in Division 07 Section "Joint Sealants."

B. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: Self-adhering glass-fiber tape, minimum 2 inches wide, 10x10 or 10x20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing board and with a history of successful in-service use.

## 2.4 MISCELLANEOUS MATERIALS

A. Flexible Flashing (Self-Adhered):
   1. Provide where shown for flashing at panels, “Blueskin Thru-Wall flashing” by Henry Company, W.R. Grace, Carlisle, or equal.
   2. Through-wall flashing membrane (Self-Adhering) shall be Blueskin TWF manufactured by Henry, W.R. Grace, Carlisle, or equal.; an SBS modified bitumen, self-adhering sheet membrane complete with a cross-laminated polyethylene film. Membrane shall have the following physical properties:
      a. Membrane Thickness: 0.0394 inches (40 mils)
      b. Film Thickness: 4.0 mils
      c. Flow (ASTM D5147): Pass @ 212 degrees F
      d. Puncture Resistance: 134 lbf to ASTM E154
      e. Tensile Strength (film): 5723 psi ASTM D882
      f. Tear Resistance: 13 lbs MD to ASTM D1004
      g. Low Temperature Flexibility: -22 degrees F to CGSB 37-GP-56M

B. Primers:
   1. Primer for self-adhering membranes at temperatures above 25 degrees F shall be Aquatac Primer manufactured by Henry, W.R. Grace, Carlisle, or equal; a polymer emulsion based adhesive, quick setting. Primer shall have the following physical properties:
      a. Color: Aqua
      b. Weight: 8.7 lbs/gal
      c. Solids by Weight: 53%
      d. Water based, no solvent odors

e. Drying time (initial set): 30 minutes at 50% RH and 70 degrees F

2. Primer for self-adhering membranes at all temperatures shall be Blueskin Adhesive manufactured by Henry W.R. Grace, Carlisle, or equal, a synthetic rubber based adhesive, quick, setting, having the following physical properties:
   a. Color: Blue
   b. Weight: 6 lbs/gal
   c. Solids by weight: 35%
   d. Drying Time (Initial Set): 30 minutes

C. Penetration and Termination Sealant:
1. Termination Sealant shall be HE925 BES Sealant manufactured by Henry W.R. Grace, Carlisle, or equal; a moisture cure, medium modulus polymer modified sealing compound having the following physical properties:
   a. Compatible with sheet air barrier, roofing and waterproofing membranes and substrate
   b. Complies with Fed. Spec. TT-S-00230C, Type II, Class A
   c. Complies with ASTM C920, Type S, Grade NS, Class 25
   d. Elongation: 450-550%
   e. Remains flexible with aging
   f. Seals construction joints up to 1 inch wide

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.
C. Securely attach to substrate by fastening as indicated, complying with the following:
   1. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
D. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.
G. Verify that surfaces and conditions are ready to accept the Work of this section. Notify architect in writing of any discrepancies. Commencement of the Work or any parts thereof shall mean acceptance of the prepared substrates. All surfaces must be sound, dry, clean, and free of oil, grease, dirt, excess mortar, or other contaminants. Fill spalled areas in substrate to provide an even plane. Strike masonry joints flush. Where curing compounds are used they must be clear resin based without oil, wax, or pigments. Do not proceed with application of air barrier membrane when rain is expected within 24 hours. Condition materials to room temperature prior to application to facilitate handling.

### 3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.
   1. Fasten gypsum sheathing to cold-formed metal framing with screws.
   2. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
   3. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
B. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.
   1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
   2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

D. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
   1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
   2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

## 3.3 SHEATHING JOINT-AND-PENETRATION TREATMENT

A. Seal sheathing joints according to sheathing manufacturer's written instructions.
   1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient quantity of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
   2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.
   3. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

## 3.4 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturers written instructions.
   1. Prime substrates as recommended by flashing manufacturer.
   2. Lap seams and junctures with other materials at least 4 inches, except that at flashing flanges of other construction, laps need not exceed flange width.
   3. Lap flashing over weather-resistant building paper at bottom and sides of openings.
   4. Lap weather-resistant building paper over flashing at heads of openings.
   5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

**END OF SECTION 06 16 00**

# SECTION 06 40 23 - INTERIOR ARCHITECTURAL WOODWORK

## 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. Plastic Laminate cabinets and wardrobes.
   2. Solid Surface material countertops.
   3. Solid Surface Window Stools
   4. Integral sinks.
   5. Utility and storage room adjustable shelving.

B. Related Sections include the following:
   1. Division 05 Section “Metal Fabrications” for perforated metal infill on casework.
   2. Division 06 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.

### 1.3 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

### 1.4 SUBMITTALS

A. Product Data: For each type of product indicated, including cabinet hardware and accessories handrail brackets and finishing materials and processes.

B. Product Data: For panel products, high-pressure decorative laminate, adhesive for bonding plastic laminate solid-surfacing material, cabinet hardware and finishing materials and processes.

C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show details full size.
   2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   3. Show locations and sizes of cutouts and holes for plumbing fixtures and other items installed in architectural woodwork.
   4. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.

D. Samples for Initial Selection:
   1. Plastic laminates.
   2. PVC edge material.
   3. Solid-surfacing materials.

E. Samples for Verification:

1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge.
2. Solid-surfacing materials, 6 inches square.
3. Exposed cabinet hardware and accessories, one unit for each type and finish.

F. Product Certificates: For each type of product, signed by product manufacturer.

G. Qualification Data: For Installer and fabricator.

## 1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Work shall meet or exceed AWS standards.

B. Installer Qualifications: Work shall meet or exceed AWS standards.

C. Quality Standard: Unless otherwise indicated, comply with WI's "Manual of Millwork" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

D. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

1. Surface-Burning Characteristics: Not exceeding values indicated below, tested per ASTM E 84 for standard time period (10 minutes).
   a. Flame Spread: 75.
   b. Smoke Developed: 450.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

## 1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is 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 woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of AWS's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
B. Wood Species and Cut for Transparent Finish: Clear Hard Maple.
C. Wood Species for Opaque Finish: Eastern white pine, sugar pine, or western white pine.
D. Wood Products: Comply with the following:
   1. Hardboard: AHA A135.4.
   2. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
   3. Particleboard: ANSI A208.1, Grade M-2.
   4. Softwood Plywood: DOC PS 1, Medium Density Overlay.
   5. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.
E. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
   1. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semiexposed edges.
F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
   1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:
      a. Abet Laminati, Inc.
      b. Arborite; Division of ITW Canada, Inc.
      c. Wilsonart International; Div. of Premark International, Inc.
      d. Formica Corporation.
      e. Lamin-Art, Inc.
      f. Nevamar Company, LLC; Decorative Products Div.
      g. Panolam Industries International Incorporated.
      h. Westinghouse Electric Corp.; Specialty Products Div.
G. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ABA Industries.
      b. Avonite, Inc.
      c. Wilsonart International; Div. of Premark International, Inc.
      d. Corian
      e. E. I. du Pont de Nemours and Company.
      f. Formica Corporation.
      g. Hanex
      h. LG Chemical, Ltd.
      i. Meganite Inc.; a division of the Pyrochem Group.
      j. Nevamar Company, LLC; Decorative Products Div.
      k. Samsung; Cheil Industries Inc.
      l. Swan Corporation (The).
      m. Transolid, Inc.
   2. Type: Standard type, unless Special Purpose type is indicated.

3. Colors and Patterns: As selected by Architect from manufacturer's full range with a minimum of 20 color options available.

H. Tempered Float Glass for Casework Doors: ASTM C 1048, Kind FT, Condition A, Type I, Class 1 (clear), Quality-Q3, with exposed edges seamed before tempering, 6mm thick, unless otherwise indicated.

I. Tempered Float Glass for Casework Shelves: ASTM C 1048, Kind FT, Condition A, Type I, Class 1 (clear), Quality-Q3; with exposed edges seamed before tempering, 6 mm thick.

## 2.2 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)."

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing.

C. Wire Pulls: Back mounted, solid metal, 5 inches long, 2-1/2 inches deep, and 5/16 inch in diameter.

D. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081. Pre-drilled holes in cabinet ends with metal shelf clips shall be acceptable.

E. Drawer Slides: BHMA A156.9, B05091.
1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.
2. File Drawer Slides: Grade 1HD-100; for drawers more than 6 inches high or 24 inches wide.
3. Pencil Drawer Slides: Grade 2; for drawers not more than 3 inches high and 24 inches wide.

F. Aluminum Slides for Sliding Glass Doors: BHMA A156.9, B07063.

G. Door Locks: BHMA A156.11, E07121. (where indicated in drawings). Tumbler locks shall be acceptable.

H. Drawer Locks: BHMA A156.11, E07041. (where indicated in drawings). Tumbler locks shall be acceptable.

I. Grommets for Cable Passage through Countertops: 2-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage. (provide 1 per everything 3’-0” of countertop)
1. Product: Subject to compliance with requirements.

J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
1. Satin Stainless Steel: BHMA 630.

K. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

## 2.3 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

D. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

E. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Wood Glues: 30 g/L.
2. Contact Adhesive: 80 g/L.

F. Adhesive for Bonding Plastic Laminate: Contact cement.
1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

## 2.4 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Premium-grade interior woodwork complying with referenced quality standard.
B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
C. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
    1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
    2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
D. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
E. Install glass to comply with applicable requirements in Division 08 Section "Decorative Glass Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

## 2.5 PLASTIC-LAMINATE CABINETS

A. Grade: Custom.
B. AWS Type of Cabinet Construction: Flush overlay.
C. WI Construction Style: Style A, Frameless.
D. WI Construction Type: Type I, multiple self-supporting units rigidly joined together.
E. WI Door and Drawer Front Style: Flush overlay.
F. Reveal Dimension: 1/4 inch.
G. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
    1. Horizontal Surfaces Other Than Tops: Grade HGS.
    2. Vertical Surfaces: Grade HGS.
    1. Edges: 3mm Edge Banding, matching laminate in color.
H. Materials for Semiexposed Surfaces: White thermally fused laminate shall be acceptable.
    1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.
        a. Edges of Plastic-Laminate Shelves: PVC tape, 0.018-inch minimum thickness, matching laminate in color, pattern, and finish.
        b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.
    2. Drawer Sides and Backs: Solid-hardwood lumber with clear coat finish on sides of each surface.
    3. Drawer Bottoms: Thermoset decorative panels.
I. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.
J. 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 in the following categories:
        a. Solid colors, gloss and matte finish.
        b. Solid colors with core same color as surface, gloss and matte finish.
        c. Wood grains, gloss and matte finish.
        d. Patterns, gloss and matte finish.
K. Provide dust panels of 1/4-inch plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

## 2.6 SOLID-SURFACING-MATERIAL COUNTERTOPS

A. Grade: Premium.
A. Solid-Surfacing-Material Thickness: 1/2 inch.
B. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:
   1. Basis of Designs (multiple): Carrara Lino by Corian and Brooklyn Concrete by Wilsonart.
   2. As selected by Architect from manufacturer's price group 1 & 2 with a minimum of 20 color options available.
C. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
   1. Fabricate tops with shop-applied edges of materials and configuration indicated.
   2. Fabricate tops with shop-applied backsplashes.
D. Provide integral sink bowls where indicated in the drawings. Install integral sink bowls in countertops in shop.
   1. Refer to drawings.
   2. Color of sink shall be selected from manufacturers full range.
E. Drill holes in countertops for plumbing fittings and other openings as indicated in the drawings.

## 2.7 UTILITY AND STORAGE SHELVING

A. Description: A heavy duty shelf system for any use. Shelf spacings that are fully adjustable with minimum three different shelf bracket lengths available.
B. Shelf Bracket: 12ga metal brackets with lengths of at least 12”, 16”, and 24”. Basis of Design #187 Super Duty Brackets by Knape & Vogt or equal by McMaster-Carr or C.R. Laurence.
C. Post: 12ga metal Slotted Upright Post to received Shelf Bracket. Basis of Design #87 Super Duty Standards by Knape & Vogt or equal by McMaster-Carr or C.R. Laurence.
   1. Post Length: 72”.
   2. Post Spacing: 2’-6” OC max for the length of shelf.
D. Shelf: Stainless Steel.
   1. Refer to drawings for number and size and shelves.
E. Finish: All parts to be powder coated.
F. Size: Refer to drawings for lengths and widths of shelves.

## 2.8 SOLID-SURFACING-MATERIAL WINDOW STOOLS

A. Grade: Premium.
B. Solid-Surfacing-Material Thickness: 3/4 inch.
C. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:
   1. As selected by Architect from manufacturer's price group 1 & 2 with a minimum of 20 color options available.
D. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
   1. Fabricate tops with shop-applied edges of materials and configuration indicated.

## 2.9 SHOP FINISHING

A. Grade: Provide finishes of same grades as items to be finished.
B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

C. General: Shop finish transparent-finished interior architectural woodwork at fabrication shop as specified in this Section. Refer to Division 09 Section "Painting" for finishing opaque-finished architectural woodwork.
D. General: Drawings indicate items that are required to be shop finished. Finish such items at fabrication shop as specified in this Section. Refer to Division 09 Section "Painting" for finishing architectural woodwork not indicated to be shop finished.
E. Shop Priming: Shop apply the prime coat including backpriming, if any, for items specified to be field finished. Refer to Division 09 Section "Painting" for material and application requirements.
F. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
    1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.
G. Transparent Finish:
    1. Grade: Premium.
    2. AWI Finish System: Catalyzed polyurethane.
    3. Staining: Selected from Manufacturer's standard color selection.
    4. Wash Coat for Stained Finish: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
    5. Filled Finish for Open-Grain Woods: After staining (if any), apply paste wood filler to open-grain woods and wipe off excess. Tint filler to match stained wood.
        a. Apply wash-coat sealer after staining and before filling.
    6. Sheen: Semigloss, 46-60 gloss units measured on 60-degree gloss meter per ASTM D 523.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.
B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

### 3.2 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.
B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.
C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
    1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
    2. Maintain veneer sequence matching of cabinets with transparent finish.

3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c.

G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
   1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
   2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
   3. Secure backsplashes to walls with adhesive.
   4. Caulk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."

H. Standing and Running Trim: Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
   1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
   2. Install trim after gypsum board joint finishing operations are completed.
   3. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.
   4. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

I. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

J. Refer to Division 09 Sections for final finishing of installed architectural woodwork not indicated to be shop finished.

## 3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

## 3.4 PROTECTION

A. Protect installed products from damage from weather and other causes during remainder of the construction period.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
   1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

**END OF SECTION 06 40 23**

# SECTION 07 11 13 - BITUMINOUS DAMPPROOFING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:
   1. Cold-applied, asphalt emulsion dampproofing.
   2. References: ASTM D1227-95, Type II Class 1, and ASTM D1187-97, Type 1

### 1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specification Sections.
B. Product data for each type of product specified, including data substantiating that materials comply with requirements for each dampproofing material specified. Include recommended method of application, recommended primer, number of coats, coverage or thickness, and recommended protection course.
C. Certification by dampproofing manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

### 1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed bituminous dampproofing similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
B. Single-Source Responsibility: Obtain primary dampproofing materials and primers from one source and by a single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.
C. Perform Work in accordance with the printed requirements of the membrane manufacturer and this specification. Advise designer of any discrepancies prior to commencement of the Work.
D. Maintain one copy of manufacturers' literature on site throughout the execution if the Work.
E. Materials used in this Section shall be fully compatible and shall be sourced and or produced by one manufacturer.

### 1.5 PROJECT CONDITIONS

A. Substrate: Proceed with dampproofing only after substrate construction and penetrating work have been completed.
B. Weather Limitations: Proceed with dampproofing only when existing and forecasted weather conditions will permit work to be performed according to manufacturer's recommendations and warranty requirements.
C. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has thoroughly cured.

D. Protection: Provide adequate protection of materials and work of this section. Make good backfilling operations and other causes. Protect work of other trades from damage resulting from work of this section. Make good such damage at own expense to satisfaction of the consultant. Apply protection board as soon as possible after installation of membrane.

## 1.6 WARRANTY

A. Warranty: Manufacturer's standard warranty which manufacturer and applicator agree(s) to repair or replace materials that fail.
   1. Warranty Period: Five years from date of Final Completion.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURER

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
   1. HE789 Fibered Asphalt Emulsion Dampproofing by Henry Company (Basis-of-Design)
   2. Cold-Applied, Asphalt Emulsion Dampproofing:
   3. ChemRex, Inc.; Sonneborn Building Products Div.
   4. Koppers Industries, Inc.
   5. Meadows: W.R. Meadows, Inc.
   6. Bituminous Dampproofing:

B. General: Provide products recommended by manufacturer for designated application.

C. Cold-Applied, Asphalt Emulsion Dampproofing: Asphalt-based emulsions recommended by the manufacturer for dampproofing use when applied according to the manufacturer's instructions.

D. (Basis-of-Design) Spray grade fibered asphalt emulsion dampproofing for temperature above 50 degrees F in compliance with ASTM D1227-95 Type II Class I for below grade exterior side dampproofing shall be HE789 Fibered Asphalt Emulsion Dampproofing, a one component dampproofing material manufactured by Henry or equal.

## 2.2 MISCELLANEOUS MATERIALS

A. Primer: Asphalt primer complying with ASTM D 41, for asphalt-based dampproofing.

# PART 3 - EXECUTION

## 3.1 PREPARATION

A. Clean substrate of projections and substances detrimental to work; comply with recommendations of prime materials manufacturer.

B. Fill voids, seal joints, and apply bond breakers, if any, as recommended by prime materials manufacturer, with particular attention at construction joints.

C. Prime substrate as recommended by prime materials manufacturer.

D. Protection of Other Work: Do not allow liquid and mastic compounds to enter and clog drains and conductors. Prevent spillage and migration onto other surfaces of work by masking or otherwise protecting adjoining work.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's recommendations except where more stringent requirements are indicated and where Project conditions require extra precautions to ensure satisfactory performance of work.
B. Application: Apply dampproofing to the following surfaces.
C. Exterior surface of inside wythe of double-wythe, exterior masonry and concrete walls above grade, to prevent water-vapor penetration through the wall.
D. Apply vertical dampproofing down masonry and concrete walls from finished-grade line to top of footing, extend over top of footing, and down a minimum of 6 inches (150 mm) over outside face of footing. Extend 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when the Project is completed.

3.3 COLD-APPLIED, ASPHALT EMULSION DAMPPROOFING

A. Spray Grade: Brush or spray apply a coat of asphalt emulsion dampproofing at a rate of 1.5 to 2.5 gal./100 sq. ft., depending on substrate texture, to produce a uniform, dry-film thickness of not less than 15 mils. Apply in 2 coats, if necessary, to obtain required thickness, allowing time for complete drying between coats.
B. Apply dampproofing by trowel or spray at a rate of 3 gal/100 foot$^2$ over the entire area and allow to cure.

3.4 PROTECTION AND CLEANING

A. Protect exterior, below-grade dampproofing membrane from damage until backfill is completed. Remove overspray and spilled materials from surfaces not intended to receive dampproofing.

**END OF SECTION 07 11 13**

# SECTION 07 13 26 – SELF-ADHERING SHEET WATERPROOFING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:
   1. Self-Adhering Waterproofing Membrane.
   2. Drainage Mat.
   3. Protection Board
   4. Related Auxiliary Materials
B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 03 Section "Cast in Place Concrete" for concrete placement, curing, and finishing.

### 1.3 PERFORMANCE REQUIREMENTS

A. General: Provide waterproofing that prevents the passage of liquid water under hydrostatic pressure and complies with requirements as demonstrated by testing performed by an independent testing agency of manufacturer's current sheet membrane.

### 1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
B. Product Data for each type of waterproofing specified, including manufacturer's printed instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties.
C. Shop Drawings showing locations and extent of waterproofing, including details for substrate joints and cracks, sheet flashings, penetrations, tie-ins with adjoining construction, and other termination conditions.
D. Samples, 3-by-6-inch minimum size, of each waterproofing material required for Project.
E. Installer certificates signed by manufacturer certifying that Installers comply with requirements under the "Quality Assurance" Article.

### 1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an Installer who has completed waterproofing similar to that indicated for this Project and who is acceptable to waterproofing manufacturer.
B. Single-Source Responsibility: Obtain waterproofing materials from a single manufacturer regularly engaged in manufacturing waterproofing.
C. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 01 Section "Project Meetings."
   1. Before installing waterproofing, meet with Owner, Architect, consultants, independent testing agency, waterproofing manufacturer, and other concerned entities.

2. Review requirements for waterproofing, including surface preparation specified under other Sections, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, inspection and testing procedures, and protection and repairs.
3. Notify participants at least 7 days before conference.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product, date of manufacture, and directions for storage.
B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer. Protect stored materials from direct sunlight.

## 1.7 PROJECT CONDITIONS

A. Environmental Conditions: Apply waterproofing within range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
   1. Do not apply waterproofing in snow, rain, fog, or mist.
B. Maintain adequate ventilation during preparation and application of waterproofing materials.

## 1.8 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: Submit a non-prorated written warranty signed by waterproofing manufacturer and Installer agreeing to repair or replace waterproofing that does not meet requirements or that does not remain watertight during the specified warranty period.
   1. Warranty Period: 5 years after date of Final Acceptance.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Available Manufacturers:
   1. Self Adhering Waterproofing Membrane
      a. Carlisle
      b. Tremco
      c. Sarnafil
      d. W.R. Grace
      e. Or equal

## 2.2 SELF-ADHERING COMPOSITE SHEET

A. Rubberized-Asphalt Composite Sheet: 60-mil- thick self-adhering sheet consisting of 56 mils of rubberized asphalt laminated to a 4-mil- thick polyethylene film with release liner on adhesive side.
   1. Sheet Type: Manufacturer's standard composite sheet for use when ambient and substrate temperatures exceed 40 deg F.

2. Physical Properties: Provide waterproofing complying with the following:
   a. Tensile Strength: 250 psi minimum; ASTM D 412, Die C, modified.
   b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
   c. Pliability: No cracks when bent 180 degrees over a 1-inch mandrel at minus 25 deg F; ASTM D 146.
   d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
   e. Puncture Resistance: 40 lbf minimum; ASTM E 154.
   f. Hydrostatic-Head Resistance: 150 feet minimum; ASTM D 5385.
   g. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.

## 2.3 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with waterproofing sheet membrane.
   1. Furnish liquid-type auxiliary materials that meet VOC limits of authorities having jurisdiction.
B. Primer: Liquid primer recommended by manufacturer of sheet waterproofing material for substrate.
C. Liquid Membrane: Elastomeric, 2-component, liquid, cold fluid-applied, trowel grade or low viscosity as recommended by waterproofing manufacturer for application.
D. Patching Membrane: Low-viscosity, 2-component, asphalt-modified coating.
E. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.
F. Penetration Seal: Self-adhering reinforced membrane, 2-1/2 inches wide, with a tack-free protective adhesive coating on 1 side and a release film on self-adhering side.
G. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9-inch centers.
H. Protection Course: As follows:
   1. Extruded polystyrene insulation in 4’X8’ sheets with joints taped.:
      a. Thickness: 1” inch

## 2.4 MOLDED-SHEET DRAINAGE PANELS

A. Composite drainage panels, 3-dimensional, nonbiodegradable, manufactured with a permeable geotextile bonded to molded-plastic-sheet drainage core and designed to effectively convey water.
   1. Geotextile: Nonwoven geotextile fabric of polypropylene or polyester fibers, or combination of both.
   2. Minimum Flow Rate: 7 gpm/foot at a hydraulic gradient of 1.0 and 3600-psf normal pressure when tested according to ASTM D 4716.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates, areas, and conditions under which waterproofing systems will be applied, with Installer present, for compliance with requirements. Do not proceed with installation until unsatisfactory conditions have been corrected.
   1. Do not proceed with installation until after minimum concrete curing period recommended by waterproofing manufacturer.
   2. Verify substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
   3. Notify Architect in writing of anticipated problems using waterproofing over substrate.

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for waterproofing application.
B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage affecting other construction.
C. Remove grease, oil, form release agents, paints, and other penetrating contaminants from concrete.
D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
E. Prepare, fill, prime, and treat joints and cracks in substrate. Remove dust and dirt from joints and cracks according to ASTM D 4258.
F. Inside Corners: Prepare, prime, and treat inside corners according to waterproofing manufacturer's written instructions.
    1. Install membrane strip centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:
        a. At footing-to-wall intersections, extend liquid membrane each direction from corner or install membrane strip centered over corner.
        b. At deck-to-wall intersections, extend liquid membrane or sheet membrane flashing onto deck waterproofing and to finished height of sheet flashing.
G. Outside Corners: Prepare and treat outside corners according to waterproofing manufacturer's written instructions.
    1. Install strip of membrane 12 inches wide, centered over corner.
H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to waterproofing manufacturer's written instructions.
    1. At expansion joints and discontinuous deck-to-wall or deck-to-deck joints, bridge and cover with sheet membrane strips.

3.3 PROTECTION COURSE INSTALLATION

A. Install protection course over waterproofing membrane using tape or adhesive according to manufacturer's written instructions and before commencing subsequent construction operations. Minimize exposure of membrane.
    1. Molded-sheet drainage panels may be used in lieu of protection course to vertical applications when approved by waterproofing manufacturer.

3.4 DRAINAGE PANEL INSTALLATION

A. Place and secure drainage panels according to manufacturer's written instructions. Use adhesives and mechanical fasteners recommended by manufacturer that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed panels during subsequent construction.
    1. For vertical applications, install insulation used as a protection course before installing drainage panel.

3.5 PROTECTING AND CLEANING

A. Protect waterproofing from damage and wear during application and remainder of construction period, according to manufacturer's written instructions.
B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

**END OF SECTION 07 13 26**

# SECTION 07 19 00 - WATER REPELLENTS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

B. Provide a Silane/Siloxane-Blend, Penetrating Water Repellent

### 1.2 SUMMARY

A. This Section includes penetrating water-repellent coatings for the following vertical and horizontal surfaces:
   1. New Masonry and other New Exterior Finish Systems.

B. Related Sections include the following:
   1. Division 03 Section "Cast-in-Place Concrete" for curing compounds, curing and sealing compounds, and penetrating liquid floor treatments.
   2. Division 04 Section "Unit Masonry" for integral water-repellent admixture for unit masonry assemblies.
   3. Division 07 Section "Joint Sealants."
   4. Division 09 Section “Painting” for paints and coatings.

### 1.3 PERFORMANCE REQUIREMENTS

A. Performance Testing: Provide water repellents that comply with test-performance requirements indicated, as evidenced by reports of tests performed by manufacturer by a qualified independent testing agency on manufacturer's standard products applied to substrates simulating those on Project using same application methods to be used for Project.
   1. Owner will engage testing agency to perform preconstruction tests on laboratory mockups.
   2. Select sizes and configurations of assemblies to adequately demonstrate capability of water repellents to comply with performance requirements.
   3. Notify Architect seven days in advance of the dates and times when assemblies will be constructed.

B. Absorption: Minimum 90 percent reduction of absorption after 24 hours in comparison of treated and untreated specimens.
   1. Brick: ASTM C 67.
   2. Stone: ASTM C 97.
   3. Concrete Unit Masonry: ASTM C 140.
   4. Hardened Concrete: ASTM C 642.

C. Water-Vapor Transmission: Maximum **10** percent reduction in rate of vapor transmission in comparison of treated and untreated specimens, per ASTM E 96.

D. Permeability: Minimum **80** percent water-vapor transmission in comparison of treated and untreated specimens, per ASTM D 1653.

E. Water Penetration and Leakage through Masonry: Maximum **90** percent reduction in leakage rate in comparison of treated and untreated specimens, per ASTM E 514.

F. Durability: Maximum **5** percent loss of water repellency after 2500 hours of weathering in comparison to specimens before weathering, per ASTM G 154.

G. Chloride-Ion Intrusion in Concrete: NCHRP Report 244, Series II tests.
1. Reduction of Water Absorption: 80 percent.
2. Reduction in Chloride Content: 80 percent.

## 1.4 SUBMITTALS

A. Product Data: For each type of product indicated.
1. Include manufacturer's printed statement of VOC content. Provide Certification that products supplied with local regulations controlling use of VOC.
2. Include manufacturer's standard colors.

B. Samples: For each type and color of water repellent and substrate indicated, 12 by 12 inches in size, with specified water-repellent treatment applied to half of each Sample.

C. Manufacturer Certificates: Signed by manufacturers certifying that water repellents comply with requirements.

D. Qualification Data: For Installer.

E. Preconstruction Testing Reports: For water-repellent-treated substrates.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for assemblies.

G. Warranty: Special warranty specified in this Section.

## 1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 548 for testing indicated.

C. Test Application: Apply a finish sample for each type of water repellent and substrate required. Duplicate finish of approved sample.
1. Locate each test application as directed by Architect.
2. Size: 25 sq. ft..
3. Final approval by Architect of color and water-repellent application will be from test applications.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 PROJECT CONDITIONS

A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:
   1. Ambient temperature is above 40 deg F.
   2. Concrete surfaces and mortar have cured for more than 28 days.
   3. Concrete or brick masonry walls are not treated prior to 30 days after building close-in.
   4. Rain or snow is not predicted within 24 hours.
   5. Application proceeds more than seven days after surfaces have been wet.
   6. Substrate is not frozen, or surface temperature is above 40 deg F.
   7. Windy conditions do not exist that may cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and applicator agree(s) to repair or replace materials that fail to maintain water repellency specified in Part 1 "Performance Requirements" Article within specified warranty period.
   1. Warranty Period: Five years from date of Final Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.2 PENETRATING WATER REPELLENTS

A. Silane/Siloxane-Blend, Penetrating Water Repellent: Clear, silane and siloxane blends with 3.3 lb/gal. or less of VOCs.
   1. Products: Hydrozo Double 7 for Brick or approved equal product by:
      a. ProSoCo, Inc.; SL 100 Water Repeller**.**
      b. Sonneborn Building Products, a division of ChemRex; White Roc 10 WB.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrate of substances that might interfere with penetration or performance of water repellents. Test for moisture content, according to water-repellent manufacturer's written instructions, to ensure that surface is dry enough.
   1. Cast-in-Place Concrete: Remove oil, curing compounds, laitance, and other substances that could prevent adhesion or penetration of water repellents.
   2. Clay Brick Masonry: Clean clay brick masonry per ASTM D 5703.

B. Test for pH level, according to water-repellent manufacturer's written instructions, to ensure chemical bond to silicate minerals.

C. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live plants and grass.

D. Coordination with Sealants: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
   1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those used in the work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 APPLICATION

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.

B. Apply a heavy-saturation spray coating of water repellent on surfaces indicated for treatment using low-pressure spray equipment. Comply with manufacturer's written instructions for using airless spraying procedure, unless otherwise indicated.
   1. Precast Concrete: At Contractor's option, first application of water repellent on precast concrete units may be completed before installing units. Mask sealant-bond surfaces to prevent water repellent from migrating onto joint surfaces.

C. Apply a second saturation spray coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

## 3.3 CLEANING

A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Repair damage caused by water-repellent application. Comply with manufacturer's written cleaning instructions.

**END OF SECTION 07 19 00**

# SECTION 07 21 00 - THERMAL INSULATION

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:
   1. Perimeter insulation under slabs-on-grade.
   2. Concealed building insulation.
   3. Roof Insulation
   4. Cavity Wall Insulation

B. Related Sections include the following:
   1. Division 04 Section "Unit Masonry" for installation of insulation in cavity walls and masonry cells.
   2. Division 07 Section “Thermoplastic Membrane Roofing” for installation of insulation.
   3. Division 09 Section "Gypsum Board" for installation in metal-framed assemblies of insulation specified by referencing this Section.
   4. Division 22 Section “Plumbing Insulation” for insulation of plumbing fixtures and piping.
   5. Division 23 Section "HVAC Insulation” for insulation of hvac fixtures, piping, and duct work.

### 1.3 DEFINITIONS

A. Thermal Resistivity: Where the thermal resistivity of insulation products are designated by "r-values," they represent the reciprocal of thermal conductivity (k-values). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivities are expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one square foot per hour at mean temperatures indicated.

### 1.4 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Samples for Verification: Full-size units for each type of exposed insulation indicated.
C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for insulation products.
D. Research/Evaluation Reports: For foam-plastic insulation.
E. Foam-plastic insulation to be part of an assembly compliant with NFPA 285. Submittal to include test report or engineering judgement (sealed) for record for entire wall assembly.

### 1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
   1. Surface-Burning Characteristics: ASTM E 84.
   2. Fire-Resistance Ratings: ASTM E 119.
   3. Combustion Characteristics: ASTM E 136.
   4. Full assembly test: NFPA 285

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

# 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 Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
   2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

## 2.2 GLASS-FIBER BLANKET INSULATION

A. Manufacturers:
   1. CertainTeed Corporation.
   2. Guardian Fiberglass, Inc.
   3. Johns Manville.
   4. Knauf Fiber Glass.
   5. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

C. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:
   1. 3-1/2 inches thick with a thermal resistance of 13 deg F x h x sq. ft./Btu at 75 deg F.
   2. 5-1/2 inches thick with a thermal resistance of 19 deg F x h x sq. ft./Btu at 75 deg F.
   3. 12 inches thick with a thermal resistance of 38 deg F x h x sq. ft/Btu at 75 deg F.

D. For Sound Attenuation, provide Unfaced Glass-Fiber Blanket Insulation over suspended ceilings at partitions in a width that extends insulation 48 inches on either side of partition and in interior wall partitions.
   1. Thickness:
      a. 5-1/2 inches thick above suspended ceiling
      b. 3-1/2 inches thick in interior wall partitions
   2. Provide sound attenuation over suspended ceilings and interior wall partitions in areas indicated in the Drawings.

2.3 FOAM PLASTIC INSULATION AT METAL WALL PANEL

A. Foil-Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Class 2, Grade 2 (20 psi). Basis of Design ECOMAXci FR by Rmax.

1. Acceptable Products and manufacturers include:
   a. EnergyShield Pro, Atlas Roofing Corporation
   b. Xci Foil Class A, Hunter Panels

B. Adhesive: Type recommended by insulation board manufacturer for application indicated.
C. Smoke Spread: less than or equal to 450.
D. Flame Spread: less than or equal to 25.
E. Product to be part of NFPA 285 assembly. See Submittals and Quality Assurance section this specification.

2.4 FOAM-IN-PLACE INSULATION

A. Polyurethane spray foam – Basis of Design Closed Cell Spray Foam Insulation
   1. Primary spray polyurethane foam building insulation shall be HE735 Permax 2.0 a spray applied polyurethane foam material as manufactured by Henry or equal. The B Component of a 2-part Polyurethane Foam system which, when combined with the appropriate A Component, will react to produce a seamless, monolithic and durable polyurethane closed cell foam insulation suitable for commercial insulating and air barrier applications.
   2. Insulation shall have the following physical properties:
      a. Thermal insulation value: R=6.0/per inch minimum, ASTM C-518
      b. Air leakage: <0.0006 L/(s.m$^2$) @ 75Pa, per ASTM E 2178
      c. Tested to ASTM E 2357 for the air barrier assembly
      d. Meet ICC AC377 standards
      e. Vapor permeance minimum: 0.95 perms @ 1in, 0.47 perms @ 2 in, per ASTM E96
      f. Aged R value minimum: >6.45/in @ 1 inch thickness, >6.2/in @ 4 inches per ASTM C518
      g. Nominal Density: 2.0 pounds per cubic foot
      h. Class 1 flame spread 25 max and smoke development 450 max when per ASTM E84 for FSI and SDI
      i. Closed cell content minimum 90% per ASTM D2856 or ASTM D6226-10.
      j. ABAA Tested and Approved Spray Polyurethane Foam
   3. Acceptable Manufacturers include:
      a. Henry Company
      b. Green Bear Insulation
      c. Gaco Western
      d. CertainTeed Corporation.
      e. Johns Manville.
      f. Premium Spray Products.
B. Auxilary Materials
   1. Furnish auxiliary materials recommended by air/vapor barrier manufacturer for intended use, compatibility and meeting ASTM E2357.
   2. Self –adhering modified asphalt/polyethylene flashing to counterflashing metal flashings Blueskin TWF by Henry Company or equal
   3. Self-adhering modified asphalt/polyethylene flashing for rough openings, window and door flashings and transitions. Blueskin SA or Blueskin SA LT by Henry Company or equal
   4. Flashing primers: liquid primer to prepare substrates for receipt of self-adhered modified asphalt/polyethylene flashings. Selection based upon local VOC regulations in effect at time of construction:
      a. AquaTac water based primer by Henry Company or equal.
      b. Blueskin Adhesive by Henry Company or equal.
      c. Blueskin LVC Adhesive by Henry Company or equal.

5. Sealant for transition strip, penetrations, and flashing membrane terminations, complying with ASTM C920, Type S, Grade NS, and ASTM C719 ±25%, Maximum VOC 5 g/l
   a. HE925 BES Sealant by Henry Company or equal.
6. Mineral Wool: Mineral Wool Board, 4 lb/cu. ft. density.

## 2.5 ROOF INSULATION

A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated. Refer to 07 41 00 for roof insulation under metal roof systems.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, felt glass-fiber mat facer on both major surfaces.
   1. Manufacturers:
      a. Atlas Roofing Corporation.
      b. Carlisle SynTec Incorporated.
      c. Celotex Corporation.
      d. Firestone Building Products Company.
      e. GAF Materials Corporation.
      f. GenFlex Roofing Systems.
      g. Johns Manville International, Inc.
      h. RMAX.
      i. Hunter Panels
      j. or equal

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to minimum slope of **1/4 inch per 12 inches**, and other slopes indicated.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

E. Minimum 1.55 pcf density

F. Roof Insulation Accessories
   1. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.
   2. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer and designed to meet all uplift loading conditions. At a minimum, provide (24) fasteners per 4’x8’ dimension for the entire roof and (32) fasteners per 4’x8’ dimension 4’-0” from the perimeter of the roof.
   3. Cold Fluid-Applied Adhesive: Manufacturer's standard cold fluid-applied adhesive formulated to adhere roof insulation to substrate.

## 2.6 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:
   1. Products:
      a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
      b. Eckel Industries of Canada; Stic-Klip Type N Fasteners.
      c. Gemco; Spindle Type.
   2. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   3. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.
   2. Do not proceed with installation of spray applied polyurethane foam insulation until placement of masonry ties, clips, connectors and continuous air/vapor barrier Work has been completed and reviewed by the Architect or Consultant.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.
   1. Clean, prepare and treat substrate according to manufacturer's written instructions. Provide clean, dust-free and dry substrate for spray polyurethane foam building insulation application. Ensure installed air/vapor barrier membrane, transition and flashing membranes are fully adhered to all applicable surfaces and capable of receiving spray polyurethane foam.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.
C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

3.4 INSTALLATION OF PERIMETER AND UNDER-SLAB INSULATION

A. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.5 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

3.6 INSTALLATION OF INSULATION IN WALLS FOR SOUND ATTENUATION

A. Install 3 1/2-inch- thick, unfaced glass-fiber blanket insulation over suspended ceilings at partitions in a width that extends insulation 48 inches on either side of partition.

## 3.7 INSTALLATION OF INSULATION AT METAL WALL PANELS

A. Installing Rigid Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
   1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry. Tape joints.

## 3.8 INSTALLATION OF FOAM-IN-PLACE INSULATION

A. Remove all loose materials that may impair bonding to the existing masonry. Apply to existing masonry walls where indicated. Apply thermal spray foam in accordance with the manufacturer's complete instructions.
B. Spray-application of spray polyurethane foam building insulation shall be installed in accordance with manufacturer's written instructions
C. Apply only when surfaces and environmental conditions are within limits prescribed by the material manufacturer.
D. Apply in consecutive passes as recommended by manufacturer to thickness as indicated on drawings to achieve the specified R-Value. Passes shall be not less than ½ inch and not greater than 2 inches.
E. Do not install spray polyurethane foam building insulation within 3 inches of heat emitting devices such as light fixtures and chimneys. Follow manufacturer's recommendation to detail.
F. Finished surface of spray polyurethane foam building insulation to be free of voids and fully sealed around embedded objects.
G. Remove masking materials and over spray from adjacent areas immediately after the foam surface has hardened. Ensure cleaning methods do not damage work performed by other sections.
H. Trim as required any excess thickness that would interfere with the application of cladding/covering system by other trades.
I. Clean and restore surfaces soiled or damaged by Work of the section.
J. Do not permit adjacent Work to be damaged by Work of this section. Damage to work of this section caused by other trades shall be repaired at the expense of the subcontractor causing the damage.
K. The Authorized Installer shall conduct daily visual inspection; adhesion/cohesion testing and density measurements as outlined by the ULC S705.2-02 Installation Standard and recorded in the Daily Work Record and kept at site for routine inspections. Copies of the Daily Work Record shall be forwarded to the owner or owner's representative upon request. Costs incurred for daily testing and inspection by the installer shall be borne by the contractor. If the inspection reveals defects, the Licensed Contractor shall immediately rectify all such defects at his cost.
L. Maximum variation from indicated thickness: minus (-) ¼ inch; plus (+) ½ inch.

## 3.9 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
B. Mask and cover adjacent areas to protect from over spray. Ensure any required foam stop or back up material are in place to prevent over-spray. Seal off any existing ventilation equipment. Install temporary ducting and fans to ensure exhaust fumes do not contribute to airborne particles. Provide for make-up air where necessary. Erect barriers, isolate area and post warning signs to advise non-protected personnel to avoid the spry area.

C. Protect the spray polyurethane foam from ultraviolet radiation installed on the exterior of a building. Cover the spray polyurethane foam with a Insulation & Air Barrier when installed on the interior of the building as specified and per building code.

3.10 INSULATION SCHEDULE

| **Location** | **Description/Location** | **Product/ Minimum Thickness** | **R-Value** | **Remarks** |
|---|---|---|---|---|
| Foundation Walls Below Finish Floor | Vertical applications | Extruded Polystyrene Minimum 2"<br><br>Provide Minimum thickness of insulation to achieve R-Values | R-10 | Cavity wall insulation shall extend below slab into the foundation walls. |
| Insulation at Metal Wall Panel Above Finish Floor | Vertical applications | Foil-Faced Polyisocyanurate Board Insulation Minimum 3"<br><br>Provide Minimum thickness of insulation to achieve R-Values | R-19 | Part of NFPA 285 assembly |
| Masonry Cavity Wall Insulation Above Finish Floor | Vertical applications | Foam in Place Closed Cell<br><br>Provide Minimum thickness of insulation to achieve R-Values | R-12 | |
| Sound Attenuation Batts (wall) | Unfaced Batt Insulation | 3 5/8” Fiberglass Batts | R-13 | Provide at all locations noted on the drawings. |
| Batt Insulation | Unfaced Batt Insulation | 12” Fiberglass Batts<br>6” Fiberglass Batts<br>3 5/8” Fiberglass Batts | R-38<br>R-19<br>R-13 | Provide at all locations noted on the drawings. |
| Roof Insulation, membrane roof | Polyisocyanurate Board Insulation | Min. 4.25” base prior to taper | R-25 | Provide (2) layers, staggered. |

**END OF SECTION 07 21 00**

## SECTION 07 26 10 – UNDER-SLAB VAPOR BARRIER

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

A. Vapor barrier, seam tape, pipe boots, detail strip, and mastic for installation directly under concrete slabs on grade.

#### 1.2 RELATED SECTIONS

A. Section 03 30 00 – Cast-in-Place Concrete: For slab on grade requirements.

#### 1.3 REFERENCES

A. ASTM International:

1. ASTM E 96 “Standard Test Methods for Water Transmission of Materials”.
2. ASTM E 154 “Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Covers.
3. ASTM E 1745 “Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs”.
4. ASTM E 1643 “Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs”.

#### 1.4 ACTION SUBMITTALS

A. Product Data: For each product indicated.

B. Samples:

1. Sheet Materials: Two, 11 by 8-1/2 inches, with vapor barrier manufacturer’s product description label affixed.
2. Seam Tape: Two, 11 inch long with backing affixed over adhesive, with vapor barrier manufacturer’s product description label affixed.

#### 1.5 INFORMATIONAL SUBMITTALS

A. Independent laboratory test results showing compliance with ASTM and ACI Standards.

#### 1.6 QUALITY ASSURANCE

A. Obtain vapor barrier membrane, seam tape, detail strips, pipe boots, and mastic from the same manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Description: Provide extremely low permeance vapor barrier for placement under concrete slabs on grade, meeting the following:

1. Permeance:

a. ASTM E 96 or ASTM E 154: 0.0057 to 0.01 perms. b.
ASTM F 1249: 0.0043 to 0.0084 perms.

B. Physical Requirements: Provide vapor barrier products meeting the following except where more stringent criteria are indicated:

1. Water Vapor Retarder: ASTM E 1745, Class A.

2.2 MANUFACTURERS

A. Subject to compliance with requirements, for use between stable substrates and concrete slab, provide one of the following products:

1. VaporBlock 15 Underslab Vapor Retarder; Viaflex, Sioux Falls, South Dakota 57104; 800 635 3456 (polyolefin).
2. Moistop Ultra “A” 15 mil; Fortifiber Building Products Systems, Reno, Nevada 89509; 800 773 4777 (polyolefin).
3. Griffolyn 15 Mil Green; Reef Industries, Inc., Houston, Texas 77275; 800 231 6074 (polyolyfin).
4. Barrier-Bak VB-350 16 mil Vapor Barrier; Inteplast Group, Ltd. Livingston, New Jersey; 973 994 8000 (polyolefin).
5. Viper Vaporcheck II 15 mil; Insulation Solutions Inc., East Peoria, Illinois 61611; 866 698 6562 (polyolefin).

2.3 ACCESSORIES

A. Seam Tape: High density polyethylene tape with pressure sensitive adhesive. Minimum width four (4) inches.

1. Color: Contrast to color of vapor barrier.

B. Pipe Boots, single penetration: Manufacturer’s preformed boots and pressure sensitive tape in accordance with vapor barrier manufacturer's published instructions.

C. Seal, multiple penetrations: Manufacturer’s flowable sealant suitable for sealing multiple penetrations.

D. Mastic: Vapor barrier manufacturer’s mastic specifically formulated to be compatible with vapor barrier and to fill voids around irregular penetrations.

PART 3 - EXECUTION

## 3.1 PREPARATION

A. Stable Substrates: Tamp or roll aggregate, sand, or earth base, level.

B. Void Forms: Ensure that void forms are installed in accordance with void form manufacture's published instructions.

## 3.2 INSTALLATION

A. Locate vapor barrier membrane system directly beneath concrete slab.

B. Install in accordance with vapor barrier manufacturer's published instructions and ASTM E 1643.

1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete casting.
2. Lap vapor barrier over footings and seal to foundation walls with manufacturer's termination bar.
3. Overlap joints six (6) inches and seal with vapor barrier manufacturer's seam tape.
4. Seal penetrations, including but not limited to pipes, conduits, and reinforcement, with pipe boots and tape.
5. Ensure that there are no penetrations of the vapor barrier except for permanent utilities and reinforcement.
6. Install pressure sensitive adhesive type with adhesive facing upward contacting concrete slab.
7. Install mastic to seal around irregular shaped penetrations.

C. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area six (6) inches all around and taping all sides or entire perimeter with seam tape.

END OF SECTION 07 26 10

# SECTION 07 26 19 – TOPICAL MOISTURE VAPOR MITIGATION SYSTEM

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:
   1. One coat, fast-curing, 100% solids epoxy moisture management system formulated to suppress excessive moisture vapor in new or existing concrete prior to the installation of a topping with sealer, or underlayment with flooring.

B. Related Sections:
   1. Division 01 Section "Allowances" for allowance pricing and quantities related to this section.
   2. Division 01 Section "Unit Prices" for unit prices related to this section.
   3. Division 09 Section "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.

### 1.3 REFERENCES

A. ASTM F2170 - Relative Humidity in Concrete Floor Slabs Using In Situ Probes
B. ASTM F1869 - Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
D. ASTM C1583 - Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension
E. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials
F. ASTM D1308 - Chemical Resistance of Finishes
G. ASTM F3010 – 13 – Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings.

### 1.4 SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.
B. Test Results: Moisture Vapor Emission Test Data
C. Product Data: Submit manufacturer's product data and installation instructions for each material and product used. Include manufacturer's Material Safety Data Sheets.
D. Qualification Data: For Installer
E. Manufacturer Pre-Installation Checklist

### 1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer.
   1. Installation of the product must be completed by a factory trained applicator using mixing equipment and tools approved by the manufacturer.

B. Single-Source Responsibility: Obtain each type of product from a single source with resources to provide products of consistent quality.
C. Manufacturer Experience: Provide products of this section by companies which have successfully specialized in production of this type of work for not less than 5 years. Contact Manufacturer Representative prior to installation.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver products in original packaging, labeled with product identification, manufacturer, batch number and shelf life.
B. Store products in a dry area with temperature maintained between 50° and 85° F (10° and 29° C) and Protect from direct sunlight.
C. Handle products in accordance with manufacturer's printed recommendations.

1.7 PROJECT CONDITIONS

A. Maintain conditions acceptable to the Manufacturer for recommended product installation.
B. Do not proceed with installation till substrate is approved and accepted for installation by the Installer and Manufacturer.
C. Do not install material below 50° F surface and air temperatures. These temperatures must also be maintained during and for 48 hours after the installation of products included in this section. Install quickly if substrate is warm and follow warm weather instructions.

1.8 WARRANTY

A. 20-Year Moisture Control Warranty
1. Certified applicator must file a pre-installation checklist with the manufacturer and receive written confirmation of the approval to proceed in order to obtain the 20-year Moisture Control Warranty.
2. Warranty shall be project specific and addressed, assigned and turned over to the Owner at the completion of the project.

PART 2 - PRODUCTS

2.1 TOPICAL MOISTURE MITIGATION SYSTEM

A. One-Coat Moisture Control System for Concrete to Receive Toppings and Underlayments.
1. Acceptable Products:
a. Ardex MC Rapid
b. Koster
c. Aquafin
d. Sonneborne
e. Thore
f. Or equal by other Manufacturer
2. Performance and Physical Properties: Meet or exceed the following values for material cured at 70° F+/-3°F (21° C+/-3°C) and 50% +/-5% relative humidity:
a. Application: Manual
b. Material Requirements on CSP 3 Prepared Concrete: Max 270 sq. ft. per mixed unit for 10 mils
c. Permeability (ASTM E96): ≤0.06 perms
d. 14 pH solution (ASTM D1308): No effect

e. VOC: 0g/L, calculated SCAQMD 1113

2.2 HYDRAULIC CEMENT UNDERLAYMENT

A. Hydraulic Cement-based Self-Leveling Underlayment.
1. Acceptable Products:
a. Ardex K60
b. Koster
c. Aquafin
d. Sonneborne
e. Thore
f. Or equal by other Manufacturer
2. Performance and Physical Properties: Meet or exceed the following values for material cured at 70° F+/-3°F (21° C+/-3°C) and 50% +/-5% relative humidity:
a. Application: Barrel Mix or Pump
b. Compressive Strength: Minimum 4100 psi at 28 days, ASTM C109M.
c. Flexural Strength: 1000 psi at 28 days, ASTM C78.
d. VOC: 0 g/l, calculated SCAQMD 1113

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.
B. 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.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Concrete Subfloors: Prepare substrate in accordance with manufacturer’s instructions.
1. Prior to proceeding please refer to ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring. All concrete subfloors must be sound, solid, clean, and free of all oil, grease, dirt, curing compounds and any substance that might act as a bond breaker before application.
2. Mechanical preparation of the surface is required to obtain a minimum ICRI concrete surface profile of 3 (CSP 3). This substrate preparation must be by mechanical means, such as shot blasting.
3. The concrete must have a minimum tensile strength of at least 150 psi for areas to receive normal foot traffic, and 200 psi for area of heavy commercial traffic when tested in accordance with ASTM C1583. The concrete surface can be damp, but must be free of standing water.
4. Prior to beginning the installation, measure the relative humidity within the concrete (ASTM F2170). For these relative humidity methods, the RH shall not exceed 100%. No standing water shall be present.
5. If the concrete substrate is too uneven to provide a uniform film thickness of the ARDEX MC RAPID or equal (typically CSP 6 or higher), the substrate can be pre-smoothed using a Self-Leveling Exterior Concrete Topping or Moisture Resistant Patch.

3.3 INSTALLATION AND APPLICATION

A. Examine substrates and conditions under which materials will be installed. Do not proceed with installation until unsatisfactory conditions are corrected.
B. Coordinate installation with adjacent work to ensure proper sequence of construction. Protect adjacent areas from contact due to mixing and handling of materials.
C. Mixing: Comply with manufacturer's printed instructions and the following.
    1. Each individual unit contains separate, pre-measured quantities of hardener (Part B) and the resin (Part A). After opening each container, stir the individual components thoroughly before blending. The hardening agent (Part B) is added to the resin (Part A).
    2. Pour all of the hardener into the resin portion and stir thoroughly for a minimum of 3 minutes using a low speed drill and an epoxy mixing paddle. Once mixed, pour some of the epoxy back into the hardener container, stir for 10 seconds, and then pour all of the contents back into the resin container. Mix for an additional 30 seconds before applying.
D. Application: Comply with manufacturer's printed instructions and the following.
    1. Apply the first coat to the prepared concrete surface in a uniform direction at an application rate of up to 270 sq. ft. per unit to achieve a coating thickness of 10 mils. Use a short-nap paint roller or notched squeegee for smoother surfaces, and a longer nap roller for more uneven substrates. To minimize the potential for pinhole formation, work the material into the surface with the roller to ensure maximum penetration. The material can also be worked into the surface with a paintbrush for hard to reach areas and corners. Once the area is completely coated, allow to dry for a minimum of 4 hours (max. 24 hours).
    2. Install underlayment according to manufacturer’s recommendations for installing over the moisture mitigation system.
    3. For Underlayment applications greater than ¼”, or if the mitigation system was not worked into the surface sufficiently enough to prevent pinholes, a third coat with sand broadcast is needed.
        a. Working at a 90° angle to the direction the first coat was applied; apply material at a coverage rate of 10 mils. While this coat is still in a fresh state (maximum 20 minutes), broadcast an excess of fine sand (less than 1/50 of an inch in grain size or 98.5% passing sieve size #35 or #30) consistently over the entire area.
        b. Use approximately 1 lb. of sand per square foot of area. Once the sand broadcast is complete, avoid all traffic over the surface for a minimum of 4 hours.
        c. After 4 hours, broom sweep and vacuum the surface to remove all loose sand. The clean, prepared surface of the sand is the priming system for the Underlayment. No additional priming is required.

3.4 FIELD QUALITY CONTROL

A. Where specified, field sampling of the products is to be done by taking an entire unopened bag/unit of the product being installed to an independent testing facility to perform testing. There is no in-situ test method applicable for this system.

3.5 PROTECTION

A. Prior to the installation of the finish flooring, the surface of the underlayment should be protected from abuse by other trades by the use of plywood, Masonite or other suitable protection course.

**END OF SECTION 07 26 19**

# SECTION 07 27 00 – AIR AND VAPOR RETARDER

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:
   1. Fluid-applied air and vapor retarder membrane.

B. Related Sections include the following:
   1. Division 04 Section "Unit Masonry" for embedded flashings.
   2. Division 09 Section "Gypsum" for wall sheathings, and wall sheathing.
   3. Division 07 low-slope roofing Sections for roof air barriers.
   4. Division 07 Section "Thermal Insulation" for insulation.
   5. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal flashings.
   6. Division 07 Section "Joint Sealants" for joint-sealant materials and installation.

### 1.3 REFERENCES

A. The following standards are applicable to this section:
   1. ASTM E2178: Standard Test Method for Air Permeance of Building Materials.
   2. ASTM E283: Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
   3. ASTM E330: Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
   4. ASTM E331: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
   5. ASTM E96: Water Vapor Transmission of Materials.
   6. CGSB 37-GP-56M: Membrane, Modified, Bituminous, Prefabricated, and Reinforced.

### 1.4 DEFINITIONS

A. ABAA: Air Barrier Association of America.
B. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

### 1.5 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous air and vapor barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air Barrier Assembly Air Leakage: Not to exceed 0.0013 L/[sec-m²] at 75 Pascals for assembly.

## 1.6 SUBMITTALS

A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.
B. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
   1. Include details of interfaces with other materials that form part of air barrier.
   2. Include details of mockups.
C. Product Certificates: For air barriers, certifying compatibility of air barrier and accessory materials with Project materials that connect to or that come in contact with the barrier; signed by product manufacturer.
D. Qualification Data: For Applicator.
E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers.

## 1.7 QUALITY ASSURANCE

A. Submit document stating the applicator of the primary air/vapor barrier membranes specified in this section is qualified by the manufacturer as suitable for the execution of the Work.
B. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance and that is an ABAA-licensed contractor, employs certified and registered installers, and complies with ABAA's Quality Assurance Program.
   1. Registration with the ABAA QAP program is required.
C. Components used shall be sourced from one manufacturer, including sheet membrane, air barrier sealants, primers, mastics, and adhesives.
D. Single-Source Responsibility:
   1. Obtain air barrier materials from a single manufacturer regularly engaged in manufacturing the product.
   2. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).
E. Mockups: Before beginning installation of air barrier, build mockups of exterior wall assembly incorporating backup wall construction, external cladding, window, door frame and sill, insulation, and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of air barrier membrane.
   1. Coordinate construction of mockup to permit inspection by Owner's testing agency of air barrier before external insulation and cladding is installed.
   2. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
   3. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
   4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
F. Preinstallation Conference: Conduct conference at Project site.
   1. Include installers of other construction connecting to air barrier, including roofing, waterproofing, architectural precast concrete, masonry, sealants, windows, glazed curtain walls, and door frames.
   2. Review air barrier requirements including surface preparation, substrate condition and pretreatment, minimum substrate curing period, forecasted weather conditions, special details and sheet flashings, mockups, installation procedures, sequence of installation, testing and inspecting procedures, and protection and repairs.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer.
B. Remove and replace liquid materials that cannot be applied within their stated shelf life.
C. Protect stored materials from direct sunlight.
D. Store role materials on end in original packaging. Protect rolls from direct sunlight until ready for use.
E. Store air barrier membranes, adhesives and primers at temperatures of 40 degrees F and rising.
F. Keep solvent away from open flame or excessive heat.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.
B. Do not install until the roof is substantially completed to protect walls from absorbing additional moisture from weather events.

1.10 WARRANTY

A. Provide manufacturer's standard 10-year material warranty.

PART 2 - PRODUCTS

2.1 FLUID-APPLIED MEMBRANE AIR AND VAPOR RETARDER

A. Fluid-Applied, Vapor Impermeable Membrane Air Barrier: Basis of Design shall be Air-Bloc 16MR by Henry; a one component elastomeric asphalt emulsion, trowel or spray applied, compatibility with substrates and transition membranes.
    1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
        a. Elastomeric Modified Bituminous Membrane:
            1) Carlisle Coatings & Waterproofing
            2) Meadows, W. R., Inc.
            3) Tremco Incorporated; ExoAir.
            4) BASF
            5) TK Products
    2. Physical and Performance Properties:
        a. Air permeability 0.0013 L/[sec-m²] @ 1.57 lbs/ft2. (75 Pascals) for a material or 0.0013 L/[sec-m²] @ 1.57 lbs./ft2 (75 Pascals) for a rated assembly.
        b. Water vapor permeance: .03 perms
        c. Wet Film Thickness, gypsum sheathing: 60 mils; Wet Film Thickness, Masonry: 90 mils.
        d. Elongation: 2000% to ASTM D 412

2.2 SELF-ADHERING SHEET AIR AND VAPOR RETARDER (AS SYSTEM FLASHING/ TRANSITION MEMBRANE AT OPENINGS)

A. Modified Bituminous Sheet: Basis of Design shall be Blueskin SA manufactured by Henry; an SBS modified bitumen, self-adhering sheet membrane complete with a thermoplastic film.

1. Available Products: Subject to compliance with requirements, provide products matching the Basis of Design by one of the following:
   a. Carlisle Coatings & Waterproofing
   b. Meadows, W. R., Inc.
   c. Tremco, Incorporated
   d. BASF
   e. TK Products
2. Physical and Performance Properties:
   a. ASTM E2357: Standard Test Method for Determining Air Leakage of Air Barrier Assemblies,
   b. Air leakage: <0.0001 CFM/ft² @1.6 lbs/ft2 to ASTM E2178 and ASTM E283 and have no increased air leakage when subjected to a sustained wind load of 10.5 lbs/ft2 for 1 hour and gust wind load pressure of 62.8 lbs/ft2 for 10 seconds when tested at 1.6 lbs/ft2 to ASTM E331,
   c. Vapor permeance: 0.03 perms to ASTM E96 (Method A),
   d. Membrane Thickness: 0.0394 inches (40 mils),
   e. Low temperature flexibility: -22 degrees F to CGSB 37-GP-56M,
   f. Elongation: 200% to ASTM D412-modifed,
   g. Meets CAN/CGSB-51-33 Type I Water Vapor Permeance requirements

## 2.3 PRIMERS

A. Primer for self-adhering membranes at temperatures above 25 degrees F shall be Aquatac Primer manufactured by Henry or equal; a polymer emulsion based adhesive, quick setting. Primer shall have the following physical properties:
   1. Weight: 8.3 lbs/gal,
   2. Solids by weight: 53%,
   3. Water based, no solvent odors,
   4. Drying time (initial set): 30 minutes at 50% RH and 70 degrees F

B. Adhesive for self-adhering membranes at all temperatures shall be Blueskin Adhesive manufactured by Henry or equal, a synthetic rubber based adhesive, quick setting, having the following physical properties:
   1. Weight: 6 lbs/gal,
   2. Solids by weight: 35%,
   3. Drying time (initial set): 30 minutes

## 2.4 JOINT TREATMENT, PENETRATION AND TERMINATION SEALANT

A. Joint Treatment, penetration and termination Sealant shall be 925 BES Sealant manufactured by Henry or equal; a moisture cure, medium modulus polymer modified sealing compound having the following physical properties:
   1. Compatible with sheet air barrier, roofing and waterproofing membranes and substrate,
   2. Complies with Fed. Spec. TT-S-00230C, Type II, Class A,
   3. Complies with ASTM C 920, Type S, Grade NS, Class 25,
   4. Elongation: 450 – 550%,
   5. Remains flexible with aging,
   6. Seals construction joints up to 1 inch wide

## 2.5 INSULATION ADHESIVE

A. Insulation adhesive shall be Air-Bloc 21 Insulation Adhesive manufactured by Henry or equal; a synthetic, trowel applied, rubber based adhesive, having the following physical properties:

1. Compatibility: With air barrier membrane, substrate and insulation,
2. Air leakage: 0.0026 CFM/ft2 @ 1.6 lbs./ft2 to ASTM E283,
3. Water vapor permeance: 0.03 perms to ASTM E96,

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
   1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
   2. Verify that concrete has cured and aged for minimum time period recommended by air barrier manufacturer.
   3. Verify that masonry joints are flush and completely filled with mortar.
   4. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 SURFACE PREPARATION

A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.
B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate patching membrane.
E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
F. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
   1. Install modified bituminous strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.
G. Bridge and cover expansion joints and discontinuous deck-to-wall and deck-to-deck joints with overlapping modified bituminous strips.
H. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
I. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

### 3.3 INSTALLATION OF AIR VAPOR RETARDER SYSTEM

A. Joint Treatment
   1. Seal joints ¼ inch and less between panels of exterior grade gypsum, gypsum sheathing, plywood, OSB or cementitious panels with joint treatment sealant over the face of the panel joint.
      a. Apply sealant along the butt joint and trowel smooth to form a continuous layer over the joint extending 1/2 inches on both sides to a uniform thickness of 1/8 inch thick.
   2. Seal gaps and voids or irregular joints greater than ¼ inch between panels of exterior grade gypsum, gypsum sheathing, plywood, OSB or cementitious panels with a strip of self-adhered air/vapor retarder transition membrane lapped a minimum of 1-1/2 inches on both sides of the joint.
      a. Prime surfaces as per manufacturers' instructions and allow to dry.

b. Align and position self-adhering air/vapor retarder transition membrane, remove protective film and press firmly into place. Ensure minimum 2 inches overlap at all end and side laps of membrane.
c. Roll all laps and membrane with a counter top roller to ensure seal.

3. Alternately, joints not exceeding 1/8 inch can be sealed with yellow open weave glass fabric.
a. Apply yellow open weave glass fabric centered over joint followed by a 1/8 inch (120mils) thick trowel application of air/vapor retarder membrane.
b. Allow to dry prior to application of primary air/vapor retarder membrane.

B. Inside and Outside Corners
1. Seal inside and outside corners of sheathing boards with a strip of self-adhering air/vapor retarder transition membrane extending a minimum of 3 inches on either side of the corner detail.
2. Prime surfaces as per manufacturers' instructions and allow to dry.
a. Align and position self-adhering transition membrane, remove protective film and press firmly into place. Ensure minimum 2 inches overlap at all end and side laps of membrane.
b. Roll all laps and membrane with a counter top roller to ensure seal.

C. Crack Treatment – Masonry and Concrete
1. Seal cracks over 1/16 inches in masonry and concrete with a strip of self-adhering air/vapor retarder transition membrane lapped a minimum of 1 1/2 inches on both sides of the crack.
a. Prime surfaces as per manufacturers' instructions and allow to dry.
b. Align and position self-adhering air/vapor retarder transition membrane, remove protective film and press firmly into place. Ensure minimum 2 inches overlap at all end and side laps of membrane.
c. Roll all laps and membrane with a counter top roller to ensure seal.
2. Alternately, static cracks 1/16 inch to 1/8 inch can be sealed with primary air/vapor retarder membrane.
a. Fill crack with primary air barrier membrane.
b. Allow to dry prior to application of primary air/vapor retarder membrane.

D. Transition Areas
1. Tie-in to structural beams, columns, floor slabs and intermittent floors, parapet curbs, foundation walls, roofing systems and at the interface of dissimilar materials as indicated in drawings with self-adhered air/vapor retarder transition membrane.
a. Prime surfaces as per manufacturers' instructions and allow to dry.
b. Align and position self-adhering air/vapor retarder transition membrane, remove protective film and press firmly into place. Provide minimum 3 inch lap to all substrates.
c. Ensure minimum 2 inch overlap at all end and side laps of membrane.
d. Roll all laps and membrane with a counter top roller to ensure seal.

E. Window and Rough Openings
1. Wrap rough openings with self-adhered membrane as detailed in manufacturer's literature.
a. Prime surfaces as per manufacturers' instructions and allow to dry.
b. Align and position self-adhering air/vapor retarder transition membrane, remove protective film and press firmly into place. Ensure minimum 2 inch overlap at all end and side laps of membrane.
c. Roll all laps and membrane with a counter top roller to ensure seal.

F. Through-Wall Flashing Membrane
1. Apply through-wall flashing membrane along the base of masonry veneer walls and over metal shelf angles as detailed.
a. Prime surfaces and allow to dry, press membrane firmly into place, over lap minimum 2 inches at all end and side laps. Promptly roll all laps and membrane to ensure the seal.
b. Applications shall form a continuous flashing membrane and shall extend up a minimum of 8 inches up the back-up wall.
c. Seal the top edge of the membrane where it meets the substrate using termination sealant. Trowel-apply a feathered edge to seal termination to shed water.
d. Install through-wall flashing membrane and extend 1/2 inch from outside edge of veneer. Provide "end dam" flashing as detailed.

G. Primary Air/Vapor Retarder – Fluid Applied

1. Apply by spray or flat trowel a complete and continuous unbroken film of liquid air/vapor and rain retarder membrane.
    a. For temperatures below 40 degrees F apply one component solvent based bitumen air/vapor retarder membrane at a rate of 18.6 sq.ft./gallon to a uniform wet thickness of 90 mils.
2. Spray apply or trowel around all projections and penetrations ensuring a complete and continuous air retarder membrane.
3. Allow air retarder membrane to dry as per manufacturers recommendations prior to placement of insulating materials.

H. Air Barrier – Self Adhered
1. Apply self-adhering air/vapor barrier membrane complete and continuous to prepared and primed substrate in an overlapping shingle fashion and in accordance with manufacturer's recommendations and written instructions. Stagger all vertical joints.
    a. Prime surfaces as per manufacturers' instructions and allow to dry.
    b. Align and position self-adhering air/vapor barrier membrane, remove protective film and press firmly into place. Ensure minimum 2 inch overlap at all end and side laps of membrane.
    c. Roll all laps and membrane with a counter top roller to ensure seal.
    d. At the end of each days work seal the top edge of the membrane where it meets the substrate with termination sealant. Trowel apply a feathered edge to seal termination and shed water.

## 3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Inspections: Air barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include the following:
1. Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Continuous structural support of air barrier system has been provided.
3. Masonry and concrete surfaces are smooth, clean and free of cavities, protrusions, and mortar droppings.
4. Site conditions for application temperature and dryness of substrates have been maintained.
5. Maximum exposure time of materials to UV deterioration has not been exceeded.
6. Surfaces have been primed, if applicable.
7. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
8. Termination mastic has been applied on cut edges.
9. Strips and transition strips have been firmly adhered to substrate.
10. Compatible materials have been used.
11. Transitions at changes in direction and structural support at gaps have been provided.
12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.
13. All penetrations have been sealed.

C. Remove and replace deficient air barrier components and retest as specified above.

## 3.5 CLEANING AND PROTECTION

A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed for more than **30** days, or as specified by the product manufacturer.
2. Protect air barrier from contact with creosote, uncured coal-tar products, TPO, EPDM, flexible PVC membranes, and sealants not approved by air barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

C. Remove masking materials after installation.

**END OF SECTION 07 27 00**

# SECTION 07 41 00 - METAL ROOF SYSTEM

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes manufactured roof, wall and soffit panels of the following types:
   1. Machine seamed standing seam roof panels.
   2. All flashings, roof top equipment flashing, curbs, ridge caps, and miscellaneous trim.
   3. All clips fasteners and anchors required to resist all uplift and loading combinations and allow thermal movement.
   4. All roof insulation, including adhesively backed membrane and other underlayments.
   5. All other accessories and components necessary for a complete, first class job.

### 1.3 DEFINITIONS

A. Preformed roofing/siding is hereby defined to include panels which are structurally capable of spanning between supports spaced as indicated.

B. Plywood: A structural board consisting of an odd number of thin layers of wood glued together under pressure, with the grain of one layer at right angles to the grain of the adjoining layer in 5, 7, 9 ply layers as required to achieve the required thickness.

### 1.4 RELATED SECTIONS

A. The following sections contain requirements that relate to this Section:
   1. Division 05 Section “Structural Steel”.
   2. Division 06 Section “Rough Carpentry” for blocking
   3. Division 07 Section "Sheet Metal Flashing and Trim" for roof and/or wall flashing, gutters, downspouts, and other sheet metal work.
   4. Division 07 Section “Thermal Insulation” for roof insulation thickness and type.

### 1.5 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide certified test results by a recognized testing laboratory or agency in accordance with specified test methods for each system.

B. **Design wind velocity for the area of the project is 146 mph** as indicated in the N.C. State Building Code and/or local ordinance. The entire roof assembly including all components shall be designed to resist all wind load combinations. Shop drawing submittals shall include all relevant calculations. Drawings and calculations shall be sealed by a professional structural engineer registered in North Carolina. Manufactured roofing systems shall also be required to provide U.L. 1-120 wind up-lift resistance. Fabricate and install system to withstand uplift loading at field, perimeters and corners in accordance with ASCE 7.
   1. Zone 1 – 51 psf.

2. Zone 2e – 68 psf within 9'-0" of an edge.
3. Zone 2r – 89 psf within 10'-0" of ridge.

C. Roof Heights, Importance Factors and other applicable calculation factors are shown on the drawings.

D. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of roof area when tested according to ASTM E 1680 at the following test-pressure difference:
1. Test-Pressure Difference: Negative 1.57 lbf/sq. ft..
2. Test-Pressure Difference: Positive and negative 1.57 lbf/sq. ft..
3. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
4. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.

E. Water Penetration: No water penetration when tested according to ASTM E 1646 at the following test-pressure difference:
1. Test-Pressure Difference: 2.86 lbf/sq. ft.
2. Test-Pressure Difference: 20 percent of positive design wind pressure, but not less than 6.24 lbf/sq. ft. and not more than 12.0 lbf/sq. ft.
3. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
4. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.

F. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.

G. FMG Listing: Provide metal roof panels and component materials that comply with requirements in FMG 4471 as part of a panel roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

H. Low sloped roof systems shall be designed and installed for wind loads in accordance with Chpt. 16 of the North Carolina Building Code – latest version and tested for resistance in accordance with ANSI/SPRI ES-1.

## 1.6 SUBMITTALS

A. Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.

B. **Product data** including manufacturer's product specifications, standard details, certified product test results, installation instructions, and general recommendations, as applicable to materials and finishes for each component and for total panel system.

C. **Samples for initial selection** purposes in form of manufacturer's color charts or chips showing full range of colors, textures, and patterns available for roof and wall panels with factory-applied finishes.

D. **Samples for verification purposes** of roof, wall and soffit panels. Provide sample panels 12 inches long by actual panel width, in the profile, style, color, and texture indicated. Include clips, battens, fasteners, closures, and other panel accessories.

E. **Shop Drawings** showing layouts of panels on walls and roofs, details of edge conditions, joints, corners, panel profiles, supports, anchorages, gutters, downspouts, trim, flashings, closures, and special details. Distinguish between factory and field assembly work.

F. **Mock-ups:** Submit full size mock-ups of all connections, corners, constructions, jointings, panel constructions, etc, including rain drainage system, as necessary to provide the Architect and Owner with a complete understanding of the system to be installed.

G. **Certification:** Submit certification prepared and sealed by a Professional Engineer, registered to practice in North Carolina, verifying that the roofing system and its anchorage meets or exceeds the loading and design requirements specified above and in the N.C. State Building Code, latest edition.

1.7 QUALITY ASSURANCE

A. **Field Measurements:** Where possible, prior to fabrication of panels, take field measurements of structure or substrates to receive panel system. Allow for trimming panel units where final dimensions cannot be established prior to fabrication.

B. **Installer Qualifications:** Engage an experienced Installer ("Roofer") to perform preformed metal roofing, siding and soffit work who has specialized in the installation of metal roofing, siding and soffit systems similar to that required for this project and who is acceptable to the manufacturer of the primary roofing materials for installation of their systems.

C. Installer Certification: Obtain written certification from manufacturer of preformed metal roofing system certifying that Installer is approved by manufacturer for installation of manufacturer's watertightness warrantied system and that Installer has held that certification for a minimum of one year prior to installation of roof.

D. Installer's Field Supervision: Require Installer to maintain a full-time supervisor/foreman who is on jobsite during times that preformed metal roofing and siding work is in progress and who is experienced in installation of roofing systems similar to type and scope required for this Project, and who is certified as indicated above.

E. **Insurance Certification:** Assist Owner in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance on roofing and associated work.

F. **UL Listing:** Provide preformed metal roofing system and component materials which have been tested for application and slopes indicated and are listed by Underwriters Laboratories, Inc. (UL) for Class A external fire exposure.

1. Assist in obtaining required approvals for substitution of preformed metal roofing system and materials in accepted U.L. designs as required.

G. **Pre-Application Roofing Conference:** Significantly prior to scheduled commencement of roofing installation and associated work, meet at project site with Installer, installer of each component of associated work, installers of deck or substrate construction to receive roofing work, installers of roof-top units and other work in and around roofing which must precede or follow roofing work (including mechanical work if any), Architect, Owner, roofing system manufacturer's representative, and other representatives directly concerned with performance of the work, including (where applicable) Owner's insurers, test agencies, and governing authorities.

1. Review foreseeable methods and procedures related to roofing work, including but not necessarily limited to the following:
2. Tour representative areas of roofing substrates (decks), inspect and discuss condition of substrate, roof drains, curbs, penetrations and other preparatory work performed by other trades.
3. Review structural loading limitations of steel deck and inspect deck for loss of flatness and for required mechanical fastening.
4. Review roofing system requirements (drawings, specifications and other contract documents).
5. Review required submittals, both completed and yet to be completed.
6. Review and finalize construction schedule related to roofing work and verify availability of materials, Installer's personnel, equipment and facilities needed to make progress and avoid delays.
7. Review required inspection, testing, certifying and material usage accounting procedures.
8. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions, including possibility of temporary roofing (if not a mandatory requirement).
9. Record (Contractor) discussions of conference, including decisions and agreements (or disagreements) reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver panels and other components so they will not be damaged or deformed. Package wall and roof panels for protection against transportation damage.

B. **Handling:** Exercise care in unloading, storing, and erecting wall and roof covering panels to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight ventilated covering. Store metal wall and roof panels so that they will not accumulate water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

## 1.9 WARRANTY

A. **Special Project Warranty:** Provide written non pro-rated warranty, signed by the Manufacturer of primary roofing materials and his authorized Installer, agreeing to replace/repair defective materials and workmanship. "Defective materials and workmanship" shall be defined to include any portion of the roofing system which leaks during the warranty period. NOTE - this warranty includes any and all insulation, underlayment, flashing, curbs and penetrations on the roof in their entirety which all of which shall be provided and installed by this contractor whether specified in this section or other sections of the specifications. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents. The metal roof system manufacturer's authorized representative shall inspect the installation and guarantee the metal roof system against leaks for a period of twenty (20) years following final acceptance of the work. Guarantee shall be in writing. Guarantee shall be equal to or exceed Single Source 1 Warranty. Manufacturer representative shall inspect the installation at appropriate stages during the construction as necessary to provide a roof warranty without exceptions or qualifications from the manufacturer. The warranty shall not be limited by wind speeds less than the design wind speed. Jurisdiction for warranty shall be the county in which the building is constructed.
   1. Warranty Period: 20 years from the date of substantial completion.

B. **Finish Warranty:** Furnish panel manufacturer's written warranty covering failure of the factory-applied exterior finish on metal wall, roof, flashing and soffit panels within the warranty period. Guarantee shall be in writing.
   1. Warranty Period: 20 years from the date of substantial completion.

C. **Contractor's 24 month warranty:** The contractor shall guarantee the materials and workmanship associated with the roofing, insulation, underlayment, flashing and sheet metal work incidental with the roofing against defects, leaks, and other failures, due to faulty material, workmanship, and/or negligence for a period of twenty-four (24) months following final acceptance of the work. All leaks and damages caused by leaks shall be repaired at the Contractor's expense. The substitution of an equal or longer term manufacturers warranty in lieu of this requirement is not acceptable. Guarantee shall be in writing and countersigned by the Prime Contractor and the Roofing Subcontractor. The warranty shall not be limited by wind speeds less than the design wind speed. Jurisdiction for warranty shall be the county in which the building is constructed

D. Note: all flashings, curbs, trim and other penetrations on the roof shall be provided, installed and fully warranted by the metal roof system manufacturer.

# PART 2 - PRODUCTS

## 2.1 ROOF SYSTEMS

A. **Available Manufacturers:** Subject to compliance with requirements, manufacturers offering metal roof, wall or soffit panel systems that may be incorporated in the work include but are not limited to the following:
   1. **"SuperLok"** standing seam roof system by MBCI, 180 degree double lock, vertical rib seamed joint standing seam metal panel or equal by but not limited to:
      a. ATAS
      b. Berridge
      c. Englert
      d. Fabral

e. McElroy
f. Metal Roofing Systems, Inc.
g. Firestone
h. Construction Metal Products, Inc.

## 2.2 SHEET MATERIALS

A. **Structural Quality Aluminum-Zinc Alloy-Coated Steel Sheet:** Hot-dip aluminum-zinc-coated steel sheet complying with ASTM A 792 with class AZ-50 coating; Grade 40 or to suit manufacturer's standards.

## 2.3 METAL FINISHES

A. **Roof panels finish:** Exposed Coil-Coated Finish:
1. 2-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. 2-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. "Kynar 500" coating consisting of a primer and a minimum 0.75-mil dry film thickness with a total minimum dry film thickness of 0.9 mil and 30 percent reflective gloss when tested in accordance with ASTM D 523. Durability: Provide coating that has been field tested under normal range of weathering conditions for minimum of 20 years without significant peel, blister, flake, chip, crack, or check in finish; without chalking in excess of No. 8 in accordance with ASTM D 659; and without fading in excess of 5 NBS units. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Roof materials comply with an SRI Index of greater than 78.

## 2.4 SNOW GUARDS

A. Prefabricated, noncorrosive units designed to be installed without penetrating metal roof panels, and complete with predrilled holes, clamps, or hooks for anchoring.
1. Snow Guards: Basis of Design: 2” I-Clad-S by Sno Gem.
2. Seam-Mounted, Snow Guards: Aluminum 2” fence with color coated metal aluminum insert.
3. Clamp Finish: Mill finish aluminum
4. Pipe: Mill finished aluminum.
   a. Height: 2”.
5. Provide Ice Flags to stop the movement of ice underneath the snow guard system.
6. Fastener: Stainless Steel.
7. Insert: Kynar Coated.

## 2.5 MISCELLANEOUS MATERIALS

A. **Fasteners:** Self-tapping screws, bolts, nuts, self-locking rivets, self-locking bolts, end-welded studs, and other suitable fasteners designed to withstand design loads.
1. Use stainless steel fasteners.

B. **“Adhesively backed membrane”:** Install “Ice and Water Shield HT” by W.R. Grace. Smooth faced and 40 mil thickness. Install horizontally staring at leave with joints lapped 4’ min. Secure to insulation as recommended by the manufacturer. Approved equal WinterGuard by CertainTeed Corporation, Weather

Watch by GAF Building Materials Corporation, Blueskin Roof High Temp PE200HT by Henry Company. Install over the entire roof surface including all vertical surfaces and turn down behind all gutters.

C. **Accessories:** Except as indicated as work of another specification section, provide components required for a complete roof or wall panel system, including trim, copings, fascias, gravel stops, mullions, sills, corner units, ridge closures, clips, seam covers, battens, flashings, gutters, downspouts, louvers, sealants, gaskets, fillers, closure strips, and similar items. Match materials and finishes of panels.
1. Sealing Tape: Pressure-sensitive 100 percent solids polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, non-sag, nontoxic, nonstaining tape.
2. Joint Sealant: One-part elastomeric polyurethane, polysulfide, or silicone rubber sealant as recommended by the building manufacturer.

## 2.6 PANEL FABRICATION

A. **General:** Fabricate and finish panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as required to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and dimensional requirements and with structural requirements. On-site fabrication of standing seam roof panels, other than curved panels, is not allowed. Site forming of curved panels will be allowed provided it is done by the manufacturer only.

B. **Apply bituminous coating** or other permanent separation materials on concealed panel surfaces where panels would otherwise be in direct contact with substrate materials that are noncompatible or could result in corrosion or deterioration of either material or finishes.

C. **Metal Gages:** Thicknesses required for structural performances, but not less than manufacturer's recommended minimums for profiles and applications indicated.
1. Roof panels shall be minimum 24-gage material thickness.

## 2.7 STANDING SEAM ROOF PANEL SYSTEM

A. **Standing Seam Roof Panel System:** Manufacturer's standard factory-formed standing-seam roof panel system designed for mechanical attachment of panels to roof deck using a concealed clip. Form panels of 24-gage aluminum-zinc-coated steel sheets.
1. Clips: Provide minimum 16-gage (0.0598-inch) galvanized panel clips designed to meet negative load requirements.
2. Cleats: Factory-calked, mechanically seamed cleats formed from minimum 24-gage, Grade C, zinc-coated steel sheets.

B. Fabricate roof system panels 16" wide, with 2" to 2-1/2" high, minimum, standing seams. All roof panels shall be 24 gauge minimum, and associated trim and flashing shall be 22 gage minimum. Panels shall have a "flat" profile, with intermediate stiffening ribs symmetrically spaced.

C. The metal roof system indicated on the Drawings and specified herein is based on the MBCI “SuperLok” system.

D. Subject to submittal of data and approval prior to bid, metal roof systems by other manufacturers complying with all requirements of this specification including materials, warranties and compliance with all wind loading.

E. All trim and roof transition flashing shall allow the roof panels to move relative to adjoining materials, including masonry walls.

F. **End Laps:** End laps are permitted only where panel run exceeds 60 feet, in which case only one end lap will be permitted. The location of end laps, if required, shall be subject to approval by the Architect. No other end laps will be acceptable.

G. **Roofing Panel Joints:** Fabricate panel joints with factory applied "in-seam" sealant to prevent capillary water leakage through panel-to-panel seams caused by wind driven rain.
1. Systems requiring field applied sealant tape systems may be acceptable to the Architect if this is part of the manufacturer's standard installation method.

H. **Ridge and Hip Closure assembly**: Ridge and hip assembly shall be designed to provide proper ventilation to prevent condensation and also prevent water penetration during the specified wind conditions. The ridge assembly shall be designed and installed to allow roof panels to ventilate and to expand and contract length-wise as the temperature of the roof panels changes.

I. **Condensation:** Fabricate panels for control of condensation, including vapor inclusion of seals and provisions for breathing, venting, weeping and draining.

2.8 AUXILIARY INSULATION MATERIALS:

A. Provide rigid polyisocyanurate insulation under metal roof at locations shown on drawings.

B. Insulation shall comply with: ASTM C578 Type IV, 25 psi, 1.55 pcf density. Minimum R value of 25.

C. **Mastic Sealer:** Type recommended by insulation manufacturer for bonding edge joints and filling voids.

D. **Mechanical Anchors:** Corrosion-resistant type as recommended by insulation manufacturer for deck type and complying with fire and insurance wind-uplift rating requirements.
1. Provide anchors of design and spacing to meet the wind loading requirements specified. Provide system tested and approved for FM 1-130 wind-uplift rating and designed to resist the specified wind loads.

E. **Thermal spacers:** Provide an air gap of approximately ½" between the bottom of the roof panel and the roof deck. Install manufacturer provided thermal spacers of size spacing and configuration to eliminate panel deflection and flutter in addition to support walking loads on the roof**.**.

F. **Flashing of existing roof top equipment:** Coordinate installation of counterflashings with assemblies which shall be protected by counterflashing and warranted as part of the metal roof system. Install counterflashings in reglets or receivers. Include all components, sealants, flashings, fasteners and other materials to provide a complete first class job.

G. **Roof-Penetration Flashing:** Coordinate roof-penetration flashing installation with roofing and installation of items penetrating roof including but not limited to plumbing, HVAC, electrical and other equipment. All flashing assemblies shall be designed by the roof system manufacturer to provide a completely warranted, waterproof roof system.

H. **Crickets**: Include crickets to divert water away from roof top curbs.

I. **Roof Edge, Eave and Trim Flashing** shall be provided and designed by the roof system manufacturer to provide a completely warranted, waterproof roof system.

PART 3 - EXECUTION

## 3.1 PANEL INSTALLATION

A. **General:** Comply with manufacturers' instructions and recommendations for installation, as applicable to project conditions and supporting substrates. Anchor panels and other components of the work securely in place, with provisions for thermal and structural movement.
   1. Field cutting of exterior panels by torch is not permitted.
   2. Install panels with concealed fasteners.
   3. Install all trim elements with butt joints and concealed splice plates, do not nest trim pieces together.
   4. Install all panels and associated trim with concealed fasteners.
   5. Where the use of occasional pop-rivets is required in the work, provide stainless steel rivets with heads colored to match the finish work.

B. **Accessories:** Install components required for complete roof, facial and soffit panel systems, including trim, copings, fascias, gravel stops, mullions, sills, corner units, ridge closures, clips, seam covers, battens, flashings, gutters, louvers, sealants, gaskets, fillers, closure strips, and similar items.

C. **Joint Sealers:** Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of panel systems. Provide types of gaskets, sealants, and fillers indicated or, if not otherwise indicated, types recommended by panel manufacturer.
   1. Provide weatherseal under ridge cap. Flash and seal roof panels at eave and rake with rubber, neoprene, or other closures to exclude weather.
   2. Refer to other sections of these specifications for product and installation requirements applicable to indicated joint sealers.

D. **Standing Seam Roof Panel System:** Fasten roof panels to supports with concealed clip in accordance with the manufacturer's instructions.
   1. Install clips at spacing required with self-drilling/self-tapping fasteners. Provide corrosion resistant fasteners as recommended by the manufacturer for the installation indicated
   2. Install roof panels in single lengths without end laps.
   3. Seaming: Complete seaming of panel joints by operation of portable power-driven equipment of type recommended by panel manufacturer to provide a weathertight joint.
   4. Provide and install curbs and flashings for all roof penetrations, including plumbing vents and mechanical penetrations.

E. **Installation Tolerances:** Shim and align panel units within installed tolerance of 1/8 inch in 20'-0" on level/plumb/slope and location/line as indicated, and within 1/16-inch offset of adjoining faces and of alignment of matching profiles.

## 3.2 ROOF PENETRATIONS

A. Provide and install roof manufacturer prescribed curb flashing, “crickets”, counter flashings and other flashing and sealants necessary to completely waterproof all roof penetrations, including all existing plumbing vents and existing mechanical penetrations to provide a complete watertight, fully warranted roof assembly.

B. **Pipe Boots:** Install metal roof system manufacturer provided roof vent pipe boots at all plumbing vents

C. **Installation Tolerances:** Shim and align panel units within installed tolerance of 1/8 inch in 20'-0" on level/plumb/slope and location/line as indicated, and within 1/16-inch offset of adjoining faces and of alignment of matching profiles.

## 3.3 CLEANING AND PROTECTIONS

A. **Damaged Units:** Replace panels and other components of the work that have been damaged or have deteriorated beyond successful repair by means of finish touch-up or similar minor repair procedures.

B. **Cleaning:** Remove temporary protective coverings and strippable films (if any) as soon as each panel is installed. Upon completion of panel installation, clean finished surfaces as recommended by panel manufacturer, and maintain in a clean condition during construction.

C. **Damaged Units:** Replace panels and other components of the work that have been damaged or have deteriorated beyond successful repair by means of finish touch-up or similar minor repair procedures.

D. **Cleaning:** Remove temporary protective coverings and strippable films (if any) as soon as each panel is installed. Upon completion of panel installation, clean finished surfaces as recommended by panel manufacturer, and maintain in a clean condition during construction.

E. Install no more insulation than can be covered in one day. Remove and dispose of any insulation that has become wet.

**END OF SECTION 07 41 00**

## SECTION 07 42 13 – METAL WALL PANELS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

A. Section Includes:
   1. Metal wall panels.
B. Related Sections:
   1. Division 05 Section "Structural Steel" for supporting metal panels.
   2. Division 05 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal panels.
   3. Division 05 Section "Rough Carpentry" for wood framing and blocking supporting metal soffit panels.
   4. Division 07 Section "Sheet Metal Flashing and Trim" for and other sheet metal work not part of metal soffit panel assemblies.
   5. Division 07 Section "Joint Sealants" for field-applied sealants not otherwise specified in this Section.
   6. Division 07 Section “Wall Cladding Support Structural Thermal Break” for fiberglass supports.

#### 1.3 SINGLE SOURCE REQUIREMENT

A. Refer to Section 07 “Metal Roof Panels”, “Metal Wall Panels”, and “Metal Soffit Panels”.
B. All metal panels associated with the Metal Roof Panel System, Metal Wall Panel System, and Metal Soffit Panel System shall be provided from a single source manufacturer without exception.

#### 1.4 REFERENCES

A. American Architectural Manufacturer's Association (AAMA):
   1. AAMA 621 - Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) & Zinc-Aluminum Coated Steel Substrates.
   2. AAMA 809.2 Voluntary Specification Non-Drying Sealants.
B. American Society of Civil Engineers (ASCE):
   1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
C. ASTM International (ASTM):
   1. ASTM A755 - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
   2. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
   3. ASTM C920 - Specification for Elastomeric
   4. ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
   5. ASTM D4214 - Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.

6. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.

1.5 DEFINITIONS

A. Wall Panel Assembly: Metal panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight wall panel and roofing system.

1.6 QUALITY ASSURANCE

A. Manufacturer/Source: Provide metal panel assemblies and accessories from a single manufacturer accredited under IAS AC472, Part B.
B. Manufacturer Qualifications: Approved manufacturer listed in this Section with minimum five years experience in manufacture of similar products in successful use in similar applications.
   1. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:
      a. Product data, including certified independent test data indicating compliance with requirements.
      b. Samples of each component.
      c. Sample shop drawings from similar project.
      d. Project References: Minimum of five installations not less than three years old, with Owner and Architect contact information.
      e. Sample warranty.
      f. Certificate of accreditation under IAS AC472 Part B.
   2. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements.
   3. Approved manufacturers must meet separate requirements of Submittals Article.
C. Installer Qualifications: Experienced Installer certified by metal panel manufacturer with minimum of five years experience with successfully completed projects of a similar nature and scope.
D. Steel Construction Publications: Comply with published recommendations in the following, unless more stringent requirements are indicated.
   1. American Institute of Steel Construction (AISC): "Steel Construction Manual."
   2. American Iron and Steel Institute (AISI): "Cold Formed Steel Design Manual."

1.7 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Prior to erection of framing, conduct preinstallation meeting at site attended by Owner, Architect, metal panel installer, metal panel manufacturer's technical representative, inspection agency and related trade contractors.
   1. Coordinate building framing in relation to metal panel system.
   2. Coordinate openings and penetrations of metal panel system.
   3. Coordinate work of Division 07 Sections "Roof Accessories" and openings and penetrations and manufacturer's accessories with installation of metal panels.

1.8 ACTION SUBMITTALS

A. Product Data: Manufacturer’s data sheets for specified products. Include data indicating compliance with performance requirements.
B. Shop Drawings: Show layouts of metal panels. Include details of each condition of installation, panel profiles, and attachment to building. Provide details at a minimum scale 1-1/2-inch per foot of edge conditions, joints, fastener and sealant placement, flashings, openings, penetrations, and special details. Make distinctions between factory and field assembled work.

1. Indicate points of supporting structure that must coordinate with metal panel system installation.
2. Include structural data indicating compliance with performance requirements and requirements of local authorities having jurisdiction.

C. Samples for Initial Selection: For each exposed product specified including sealants. Provide representative color charts of manufacturer's full range of colors.

D. Samples for Verification: Provide 12-inch- long section of each metal panel profile. Provide color chip verifying color selection.

## 1.9 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Indicating compliance of products with requirements.

B. Qualification Information: For Installer firm and Installer's field supervisor.

C. IAS Accreditation Certificate: Indicating that manufacturer is accredited under provisions of IAS AC472 Part B.

D. Manufacturer's warranty: Unexecuted sample copy of manufacturer's warranty.

## 1.10 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Manufacturer's Warranty: Executed copy of manufacturer's warranty.

## 1.11 PERFORMANCE REQUIREMENTS

A. General: Provide metal panel system meeting performance requirements as determined by application of specified tests by a qualified testing facility on manufacturer's standard assemblies.

B. Delegated Design: Design wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, registered in the State of North Carolina, using performance requirements and design criteria indicated.

Structural Performance: Provide metal panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated, as determined by ASTM E1592:

1. Wind Loads: Determine loads based on uniform pressure, importance factor, exposure category, and basic wind speed indicated on drawings.
   a. Wind Negative Pressure: Certify capacity of metal panels by actual testing of proposed assembly.
2. Deflection Limits: Withstand inward and outward wind-load design pressures in accordance with applicable building code with maximum deflection of 1/120 of the span with no evidence of failure.
3. Seismic Performance: Comply with ASCE 7 Sections 9, "Earthquake Loads."

C. North Carolina State Building Code Compliance: Provide metal roof and wall panels complying with requirements for installation under North Carolina State Building Code for **146 mph** velocity wind zone.

D. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction. Allow for deflection and design for thermal stresses caused by temperature differences from one side of the panel to the other.

## 1.12 DELIVERY, STORAGE, AND HANDLING

A. Protect products of metal panel system during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage. Protect panels and trim bundles during shipping.

1. Deliver, unload, store, and erect metal panels and accessory items without misshaping panels or exposing panels to surface damage from weather or construction operations.

2. Store in accordance with Manufacturer's written instruction. Provide wood collars for stacking and handling in the field.
3. Shield foam insulated metal panels from direct sunlight until installation.

## 1.13 WARRANTY

A. Special Warranty: Manufacturer's custom form in which manufacturer agrees to repair or replace panels that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including rupturing, cracking, or puncturing.
      b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   2. Warranty Period: 20 years from date of Substantial Completion.

B. Special Panel Finish Warranty: On Manufacturer's standard form, in which Manufacturer agrees to repair or replace metal panels that evidence deterioration of factory-applied finish within the warranty period, as follows:
   1. Fluoropolymer Two-Coat System:
      a. Basis of Design System: MBCI, Signature 300.
      b. Color fading in excess of 5 Hunter units per ASTM D 2244.
      c. Chalking in excess of No. 8 rating per ASTM D 4214.
      d. Failure of adhesion, peeling, checking, or cracking.
      e. Warranty Period: 20 years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURER

A. Provide basis of design product, or comparable product approved by Architect from one of the following:
   1. MBCI
   2. Overly Manufacturing Company
   3. ATAS
   4. Berridge
   5. McElroy
   6. Metal Roofing Systems, Inc.
   7. Morin
   8. Firestone
   9. Englert
   10. Fabral
   11. Dimensional Metals, Inc.
   12. Construction Metal Products, Inc. (CMP)

## 2.2 METAL WALL PANELS

A. Smooth-Profile, Concealed Fastener Metal Wall Panels: Structural metal panels consisting of formed metal sheet with fastener leg for concealed attachment to wall framing.
   1. Basis of Design: FW-120 Metal Wall Panel by MBCI.
   2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, structural quality, Grade 50, Coating Class AZ50, pre-painted by the coil-coating process per ASTM A755/A755M.
      a. Nominal Thickness: 24 gauge coated thickness, with smooth surface.
   3. Panel Width: 12 inches.
   4. Panel Thickness: 1 1/2" inch.
   5. Application: Vertical.

6. Panel joint: Tongue and groove interlock joint.
7. Panel finish: Fluoropolymer, two-coat minimum, metallic color system.
8. Panel texture: Smooth.
9. Color: To be selected from manufacturer's full range of color selections, including all metallic and aluminum color options.

## 2.3 METAL WALL PANELS, PERFORATED

A. Smooth-Profile, Perforated, Concealed Fastener Metal Wall Panels: Structural metal panels consisting of formed metal sheet with fastener leg for concealed attachment to roof equipment screen wall framing.
   1. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, structural quality, Grade 50, Coating Class AZ50, pre-painted by the coil-coating process per ASTM A755/A755M.
      a. Nominal Thickness: 24 gauge coated thickness, with smooth surface.
   2. Panel Width: 12 inches.
   3. Panel Thickness: 1 1/2" inch.
   4. Perforations: 3/16" holes, 5/16" staggered centers with 33% open area
   5. Application: Vertical.
   6. Panel joint: Tongue and groove interlock joint.
   7. Panel finish: Fluoropolymer, two-coat minimum, metallic color system.
   8. Panel texture: Smooth.
   9. Color: To be selected from manufacturer's full range of color selections, including all metallic and aluminum color options.

## 2.4 MISCELLANEOUS MATERIALS

A. General: Provide complete metal panel assemblies incorporating trim, copings, fasciae, gutters and downspouts, and miscellaneous flashings. Provide required fasteners, closure strips, and sealants as indicated in manufacturer's written instructions.
B. Flashing and Trim: Match material, thickness, and finish of metal panels.
C. Panel Fasteners: Self-tapping screws and other acceptable fasteners recommended by metal panel manufacturer. Where exposed fasteners cannot be avoided, supply corrosion-resistant fasteners with heads matching color of metal panels by means of factory-applied coating, with weathertight resilient washers.

## 2.5 FABRICATION

A. General: Provide factory fabricated and finished metal panels, trim, and accessories meeting performance requirements, indicated profiles, and structural requirements.
B. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions, approved shop drawings, and project drawings.

## 2.6 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Finishes, General: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
E. Fluoropolymer Two-Coat System: 0.2 – 0.3 mil primer with 0.7 - 0.8 mil 70 percent PVDF fluoropolymer color coat, AAMA 621.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine metal panel system substrate with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal panels.
   1. Inspect framing that will support insulated metal panels to determine if support components are installed as indicated on approved shop drawings and are within tolerances acceptable to metal panel manufacturer and installer. Confirm presence of acceptable framing members at recommended spacing to match installation requirements of metal panels.
B. Correct out-of-tolerance work and other deficient conditions prior to proceeding with insulated metal panel installation.

### 3.2 PREPARATION

A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.
B. Miscellaneous Framing: Install subpurlins, eave angles, furring, and other miscellaneous roof panel support members and anchorage according to metal roof panel manufacturer's written instructions.
   1. Secure furring to supports, as required to comply with requirements for assemblies indicated.

### 3.3 METAL PANEL INSTALLATION

A. Concealed-Fastener Formed Metal Panels: Install metal panel system in accordance with manufacturer's written instructions, approved shop drawings, project drawings, and referenced publications. Install metal panels in orientation, sizes, and locations indicated. Anchor panels and other components securely in place. Provide for thermal and structural movement.
B. Fasten metal panels to supports with fasteners at each location indicated on approved shop drawings, at spacing and with fasteners recommended by manufacturer. Fasten panel to support structure through leading panel flange. Snap-fit back flange of subsequent panel into secured flange of previous panel. Where indicated, fasten panels together through flush-fitted panel sides.
   1. Cut panels in field where required using manufacturer's recommended methods.
   2. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by metal panel manufacturer.
C. Attach panel flashing trim pieces to supports using recommended fasteners.

### 3.4 ACCESSORY INSTALLATION

A. General: Install metal panel accessories with positive anchorage to building and weather tight mounting; provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal panel assembly, including trim, copings, flashings, sealants, closure strips, and similar items.
   2. Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.

3. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

C. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

## 3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where inspections indicate that they do not comply with specified requirements.

C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

## 3.6 CLEANING AND PROTECTION

A. Clean finished surfaces as recommended by metal panel manufacturer.

B. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

C. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.

D. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

**END OF SECTION 07 42 13**

# SECTION 07 42 93 - METAL SOFFIT PANELS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:
   1. Metal soffit panels.
B. Related Sections:
   1. Division 05 Section "Structural Steel" for supporting metal panels.
   2. Division 05 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal roof panels.
   3. Division 05 Section "Rough Carpentry" for wood framing and blocking supporting metal soffit panels.
   4. Division 07 Section "Sheet Metal Flashing and Trim" for and other sheet metal work not part of metal soffit panel assemblies.
   5. Division 07 Section "Joint Sealants" for field-applied sealants not otherwise specified in this Section.

### 1.3 SINGLE SOURCE REQUIREMENT

A. Refer to Section 07 “Metal Roof Panels”, “Metal Wall Panels”, and “Metal Soffit Panels”.
B. All metal panels associated with the Metal Roof Panel System, Metal Wall Panel System, and Metal Soffit Panel System shall be provided from a single source manufacturer without exception.

### 1.4 DEFINITIONS

A. Preformed Soffit: Preformed soffit is hereby defined to include panels which are structurally capable of spanning between supports spaced as indicated.

### 1.5 PERFORMANCE REQUIREMENTS

A. General Performance: Metal soffit panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
B. Delegated Design: Design metal soffit panel assembly, including comprehensive engineering analysis by a qualified professional engineer, registered in the State of North Carolina, using performance requirements and design criteria indicated.
C. Wind-Uplift Resistance: Provide metal soffit panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
   1. Uplift Rating: Based on manufacturer’s engineering due to specified wind speed of **146 mph**.
   2. Wind Loads for soffit panels: Determine loads based on the following minimum design wind pressures:
   3. Basic wind zone **146 mph** as listed in the North Carolina State Building Code 2018.

D. FMG Listing: Provide metal panels and component materials that comply with requirements in FMG 4471 as part of a panel roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
   1. Fire/Windstorm Classification: Class 1A-120.
   2. Wind Loads for soffit panels: Determine loads based on the following minimum design wind pressures:
      a. Basic wind zone **146 mph** as listed in the North Carolina Building Code 2018.

E. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

F. Thermal Performance: Provide insulated metal roof panel assemblies with thermal-resistance value (R-value) indicated when tested according to ASTM C 518.

## 1.6 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of roof panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal panels; details of edge conditions, side-seam and endlap joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.
   1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
      a. Flashing and trim.

C. Certified Test Results: Design wind velocity for the area of the project is 90 mph as indicated in the N.C. State Building Code and/or local ordinance. The entire soffit assembly including all components shall be designed to resist all wind load combinations. Shop drawing submittals shall include all relevant calculations. Drawings and calculations shall be sealed by a professional structural engineer registered in North Carolina. For soffit systems, fabricate and install system to withstand a minimum loading of 20 psf inward and 20 psf outward.

D. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.
   1. Include similar Samples of trim and accessories involving color selection.

E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
   1. Metal Soffit: 12 inches long by actual panel width. Include fasteners, clips, battens, closures, and other metal roof panel accessories.
   2. Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
   3. Accessories: 12-inch- long Samples for each type of accessory.

F. Delegated-Design Submittal: For metal panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

G. Qualification Data: For qualified Installer.

H. Material Certificates: For thermal insulation and vapor retarders, from manufacturer.

I. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

J. Field quality-control reports.

K. Maintenance Data: For metal roof panels to include in maintenance manuals.

L. Warranties: Samples of special warranties.

## 1.7 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
   1. Installer Certification: Obtain written certification from manufacturer of preformed system certifying that Installer is approved by manufacturer for installation of manufacturer's water

tightness warrantied system and that Installer has held that certification for a minimum of one year prior to installation.

2. Installer's Field Supervision: Require Installer to maintain a full-time supervisor/foreman who is on jobsite during times that preformed work is in progress and who is experienced in installation of soffit systems similar to type and scope required for this Project, and who is certified as indicated above.

B. Source Limitations: Obtain each type of metal panels from single source from single manufacturer.

## 1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect strippable protective covering on metal roof panels from exposure to sunlight and high humidity, except to extent necessary for period of metal roof panel installation.

E. Protect foam-plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## 1.9 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit metal roof panel work to be performed according to manufacturer's written instructions and warranty requirements.

B. Field Measurements: Verify actual dimensions of construction contiguous with metal panels by field measurements before fabrication.

## 1.10 COORDINATION

A. Coordinate sizes and locations of penetrations with actual equipment provided.

## 1.11 WARRANTY

A. Special Warranty: Manufacturer's custom form in which manufacturer agrees to repair or replace panels that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including rupturing, cracking, or puncturing.
   b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Warranty Period: 20 years from date of Final Completion.

B. Special Warranty on Panel Finishes: Manufacturer's custom form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.

b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Final Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURER

A. Provide basis of design product, or comparable product approved by Architect from one of the following:
1. MBCI
2. Overly Manufacturing Company
3. ATAS
4. Berridge
5. McElroy
6. Metal Roofing Systems, Inc.
7. Morin
8. Firestone
9. Englert
10. Fabral
11. Dimensional Metals, Inc.
12. Construction Metal Products, Inc. (CMP)

### 2.2 METAL SOFFIT MATERIALS

A. Basis of Design: “Artisan Series Panel” Soffit System by MBCI.
1. Thickness: Soffit will be .032”
2. Panel Width: 12” with intermediate stiffening rib added at 6”, symmetrically between panel ribs.
3. Panel Height: 1”
4. Texture: Panels shall be Flush, Smooth Solid Panels.
5. Material: 24 gauge Aluminum-Zinc Alloy-Coated Steel Sheet
6. Vent: Provide perforated vented panel every 4’-0”
7. Panels shall be interlocking design and concealed fasteners.
8. Finish: Soffit shall be selected from manufacturers standard color selections.
a. 2-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. 2-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. "Kynar 500" coating consisting of a primer and a minimum 0.75-mil dry film thickness with a total minimum dry film thickness of 0.9 mil and 30 percent reflective gloss when tested in accordance with ASTM D 523. Durability: Provide coating that has been field tested under normal range of weathering conditions for minimum of 20 years without significant peel, blister, flake, chip, crack, or check in finish; without chalking in excess of No. 8 in accordance with ASTM D 659; and without fading in excess of 5 NBS units. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
9. Color: To be selected from manufacturer’s full range of color selections, including all metallic and aluminum color options.

2.3 MISCELLANEOUS MATERIALS

A. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Use concealed fasteners.

2.4 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
D. Finishes, General: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
E. Fluoropolymer Two-Coat System: 0.2 – 0.3 mil primer with 0.7 - 0.8 mil 70 percent PVDF fluoropolymer color coat, AAMA 621.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.
B. Miscellaneous Framing: Install subpurlins, eave angles, furring, and other miscellaneous roof panel support members and anchorage according to metal roof panel manufacturer's written instructions.
   1. Soffit Framing: Secure furring to supports, as required to comply with requirements for assemblies indicated.

3.3 METAL PANEL INSTALLATION

A. Formed Metal Panels: Install metal panel system in accordance with manufacturer's written instructions, approved shop drawings, project drawings, and referenced publications. Install metal panels in orientation, sizes, and locations indicated. Anchor panels and other components securely in place. Provide for thermal and structural movement.
B. Fasten metal panels to supports with fasteners at each location indicated on approved shop drawings, at spacing and with fasteners recommended by manufacturer. Fasten panel to support structure through leading flange. Snap-fit back flange of subsequent panel into secured flange of previous panel.
   1. Cut panels in field where required using manufacturer's recommended methods.
   2. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by metal panel manufacturer.
C. Attach panel flashing trim pieces to supports using recommended fasteners and joint sealers.

D. Joint Sealers: Install liquid sealants where indicated and where required for weatherproof performance of metal panel assemblies.
   1. Seal panel base assembly, openings, panel head joints, and perimeter joints using joint sealers indicated in manufacturer's instructions.
   2. Seal perimeter joints between window and door openings and adjacent panels using elastomeric joint sealer.
   3. Prepare joints and apply sealants per requirements of Division 07 Section "Joint Sealants."

## 3.4 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal panel assembly including trim, copings, closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

C. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

D. Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.

E. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.

## 3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where inspections indicate that they do not comply with specified requirements.

C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

## 3.6 CLEANING

A. Clean finished surfaces as recommended by metal panel manufacturer.

B. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

C. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.

D. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

**END OF SECTION 07 42 93**

# SECTION 07 48 00 – WALL CLADDING SUPPORT STRUCTURAL THERMAL BREAK

## 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. Thermally broken, exterior wall panel support/attachment system to meet ASHRAE 90.1 wall assembly U value and continuous insulation requirements.

B. Related Sections:
   1. Division 05 Section "Structural Steel" for supports.
   2. Division 05 Section "Cold-Formed Metal Framing" for cold-formed metal framing supports.
   3. Division 05 Section "Rough Carpentry" for wood framing and blocking.
   4. Division 07 Section "Sheet Metal Flashing and Trim" for and other sheet metal work.
   5. Division 07 Section "Joint Sealants" for field-applied sealants not otherwise specified in this Section.

### 1.3 REFERENCES STANDARDS

A. ASCE American Society of Civil Engineers (www.asce.org)
   1. ASCE 7 – Minimum Design Loads for Buildings and Other Structures; 2010 with Supplements and Errata
   2. ASCE – Structural Plastics Design Manual

B. ASHRAE American Society of Heating, Refrigerating, and Air-Conditioning Engineers (www.ashrae.org)
   1. ASHRAE 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings; 2013
   2. ASHRAE 189.1 – Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings; 2014

C. ASTM International (American Society for Testing and Materials; www.astm.org)
   1. ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015
   2. ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2015
   3. ASTM C553 ¬– Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013
   4. ASTM C612 – Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014
   5. ASTM C754 – Standard Specification for Installation of Steel Framing Members to Receive Screw Attached Gypsum Panel Products; 2015
   6. ASTM C1177/C1177M – Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013
   7. ASTM C1363 – Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus; 2011
   8. ASTM C1396/C1396M – Standard Specification for Gypsum Board; 2014a

9. ASTM D256 – Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010e1
10. ASTM D570 – Standard Test Method for Water Absorption of Plastics; 2010e1
11. ASTM D635 – Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2014
12. ASTM D638 – Standard Test Method for Tensile Properties of Plastics; 2014
13. ASTM D696 – Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between minus 30 degrees C and 30 degrees C with a Vitreous Silica Dilatometer; 2008e1
14. ASTM D695 – Standard Test Method for Compressive Properties of Rigid Plastics; 2015
15. ASTM D790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials; 2010
16. ASTM D792 – Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement; 2013
17. ASTM D2583 – Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor; 2013a
18. ASTM D2842 – Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2012
19. ASTM D4385 – Standard Practice for Classifying Visual Defects in Thermosetting Reinforced Plastic Pultruded Products; 2013
20. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a
21. ASTM E96/E96M – Standard Test Methods for Water Vapor Transmission of Materials; 2015
22. ASTM E283 – Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 04(2012)
23. ASTM E2178 – Standard Test Method for Air Permeance of Building Materials; 2013

D. IBC – International Building Code (International Code Council); 2012

E. NFPA – National Fire Protection Association (www.nfpa.org)
   1. NFPA 285 – Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2012

## 1.4 PERFORMANCE REQUIREMENTS

A. System Thermal Design: Ensure installed insulation and composite rainscreen framing system, sub-framing, clips and cladding attachment does not have thermal bridging of fasteners or framing that creates a continuous metal path from exterior surface of insulation to interior face of insulation.
   1. System thermal design shall meet or exceed thermal design requirements as indicated.
   2. Thermal Resistance: Wall assembly R Value of 19 minimum.
   3. Wall assembly shall not have structural connections (beams, support framing, sub girts, clips) which create thermal bridging.

B. Structural Design: Exterior wall/cladding panel assemblies are required to demonstrate the ability to meet the following:
   1. Live loads such as wind and snow loads, dead load and design criteria as indicated.
   2. Thermal movements and structural loading requirements within temperature range of minus 55 degrees F to 180 degrees F.
   3. Provide comprehensive engineering analysis by a professional engineer registered in the State of North Carolina which includes the wall panel manufacturer’s analysis of design loads (sealed).

C. Standard Fire Test Method: Wall Cladding Support System to be part of an assembly in compliance with NFPA 285. Submittal to include test report or engineering judgement (sealed) for record for entire wall assembly. Coordinate with other Division 5 and Division 7 sections for components.

D. Fire-Test-Response Characteristics: Provide composite framing support system with fire-test results indicated as determined by test standard indicated and applied by UL or other testing and inspection agency acceptable to authorities having jurisdiction.
   1. Surface Burning Characteristics: In compliance with ASTM E84, for foam insulation, fiber reinforced polymer (FRP) and interior surfaces as follows:

a. Flame Spread Index (FSI): 25 or less.
b. Smoke Developed Index (SDI): 450 or less.

## 1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate construction of wall cladding support system over substrate indicated for proper drainage, flashing, trim, back-up support, soffits, and other related Work.
   1. Review and finalize construction schedule.
   2. Verify availability of materials, installer's personnel, equipment, and facilities needed to maintain schedule.
   3. Review means and methods related to installation, including manufacturer's written instructions.
   4. Examine support conditions for compliance with requirements, including alignment and attachment to structural support system.
   5. Review flashings, wall cladding details, wall penetrations, openings, and condition of other construction that affects this Work.
   6. Review temporary protection requirements for during and after installation of this Work.

## 1.6 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions.
B. Shop Drawings: Submit shop drawings showing details of construction, and relationship of cladding/wall panels with adjacent construction including fastening and/or anchorage connection details, Z girt thermal break size and thickness. Provide details including:
   1. Typical wall sections.
   2. Typical top of wall, base of wall, corners, window head, jamb and sill details, and changes of materials.
   3. Coordinate details with wall framing shop drawings.
C. Engineering Calculations: Provide engineering calculations that demonstrate compliance with the load requirements.
D. Product Test and Inspection Reports: Submit test and inspection reports on each type of wall cladding/veneer system based on evaluation of comprehensive tests performed by nationally recognized testing agency.

## 1.7 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division01.
B. Mock-Ups: Complete wall assembly at location at Architect’s direction.
C. Delegated Design: Provided by a professional engineer registered in the State of North Carolina.
D. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with at least three years of documented experience.
E. Installer: Company specializing in performing work of this section and the following:
   1. Install system in strict compliance with manufacturer’s installation instructions.
   2. Have not less than three years of documented experience.

## 1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer’s original unopened containers and packaging with labels clearly identifying product name and manufacturer.
B. Deliver components and other manufactured items or accessories without damage or deformation.

C. Storage: Store materials in clean, dry, and level interior areas or outdoor areas for limited duration in accordance with manufacturer's written instructions.
D. Protect components and auxiliary accessories during transportation, handling, and installation from moisture, excessive temperatures and other construction operations in accordance with manufacturer's written instructions.
E. Handle components in strict compliance with manufacturer's written instructions and recommendations, and in a manner to prevent bending, warping, twisting, and surface, edge or corner damage.

## 1.9 SITE CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of this Work in accordance with manufacturer's written installation instructions and warranty requirements.

## 1.10 WARRANTY

A. Warranty: Provide manufacturer's standard limited warranty against defects in manufacturing.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURER

A. Provide basis of design product, or comparable product approved by Architect from one of the following:
B. Basis of Design: Subject to compliance with requirements, provide a thermally broken composite material rainscreen framing system by Advanced Architectural Products (A2P): SMARTci GreenGirt or a comparable system by one of the following:
   1. Knight Wall Systems, ThermaZee (continuous metal Z GIRT system)
   2. Cladiator, Slotted Z (continuous fiberglass Z GIRT system)

## 2.2 THERMALLY BROKEN WALL/CLADDING PANEL SUPPORT ATTACHMENT, METAL

A. Steel Sheet:
   1. Steel classification: Structural steel, 50 ksi yield strength.
   2. Corrosion protection coating: ASTM A1046, zinc-aluminum-magnesium, minimum thickness ZM40.

B. Components:

1. Comply with ANSI/ASHRAE 90.1.

2. Primary Horizontal Girts:

   a. Profile: ThermaZee; z-channel, front and back flanges of equal length, with attachment holes.

   b. Thickness: Minimum16 gage.

   c. Web perforations: Minimum 50 percent open area.

   d. Depth: 3”

e. Thermal isolation located between back flange and substrate; continuous along length of channel. Minimum 0.25 inch thickness. Thermal conductivity: Less than 0.18 Watts per Meter Kelvin. Designed to prevent accumulation of liquid water on upper edge.

f. Finish: Mill.

3. Wall Anchors: Corrosion resistant coated steel; thermally isolated with minimum 1/8 inch thick polymer washer; type, spacing and embedment as system engineer requires.

## 2.3 THERMALLY BROKEN WALL/CLADDING PANEL SUPPORT ATTACHMENT, FIBERGLASS

A. Structural Thermal Break Material:
   1. Compressive Strength: ASTM D638, 40,000 psi.
   2. Compressive Modulus: ASTM D695, 673,400 psi.
   3. Shear Strength: ASTM D732, 16,000 psi.
   4. Thermal Conductivity: ASTM C518, 1.05 BTU in/ hr sf degree F.
   5. Coefficient of Thermal Expansion: ASTM E831, 2.2 x 10e-6 in/in/degree F.
   6. Thermal Resistance (R value): ASTM C518, 0.95 hr sf degree F/ BTU.
   7. Surface Burning Characteristics: ASTM E84.
      a. Flame Spread: 25 (class A).
      b. Smoke Developed: 50 (class A)

B. Spacing: Refer to manufacturer's recommendations and comply with project specific calculations

C. Connectors and Fasteners: Minimum ultimate pullout capacity shall be 450 pounds.

D. Provide system consisting of polyester and vinyl ester bioresin matrix (FRP) with recycled materials, fire retardant additives and integral continuous metal inserts the length of profile. Reinforce system with glass strand rovings used internally for longitudinal (lengthwise) strength and continuous strand glass mats or stitched reinforcements used internally for transverse (crosswise) strength.
   1. Depth of GreenGirt: 3 inch deep.
   2. On Center Spacing: 16 inches min.
   3. Provide continuous non-corrosive steel insert for engagement of fasteners, at least 16 gage thick with G90 galvanized coating designation in compliance with ASTM A653/A653M.
      a. Fully engage steel insert with adjacent framing system at ends.
      b. Anchor sub-girts and other wall cladding support accessories to steel insert set into and part of framing system.
      c. Provide screw pullout that meets or exceeds the structural load requirements indicated.
   4. Provide integral anti-siphon grooves on exterior and interior flanges of framing system.
   5. Provide force distribution zones integrally designed into profile of framing system.
   6. Surface Burning Characteristics:
      a. Flame Spread Index (FSI): 25 or less, when tested in accordance with ASTM E84.
      b. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   7. Flammability: Comply with ASTM E84.
   8. Self-Extinguishing: Comply with ASTM D635.
   9. Profile Visual Requirements: Comply with ASTM D4385.
   10. Tensile Stress: Provide engineered lengthwise and crosswise tensile stress in compliance with performance loading criteria and specified safety factors, in accordance with ASTM D638.
   11. Compressive Stress: Provide engineered lengthwise and crosswise compressive stress in compliance with performance loading criteria and specified safety factors, in accordance with ASTM D695.
   12. Flexural Stress: Provide engineered lengthwise and crosswise flexural stress in compliance with performance loading criteria and specified safety factors, in accordance with ASTM D790.
   13. Modulus of Elasticity: Engineered to meet performance loading criteria and specified safety factors.
   14. Barcol Hardness: 45, in accordance with ASTM D2583.
   15. Water Absorption: Less than 0.46 percent by weight, within 24 hours, tested in accordance with ASTM D570.

16. Density: Within range of 0.062 to 0.070 lbs/cubic inch, in accordance with ASTM D792.
17. Lengthwise Coefficient of Thermal Expansion: 7.0 x $10^{-6}$ inch/inch/degrees F, in accordance with ASTM D696.
18. Notched Izod Impact, Lengthwise: 24 ft lbs/inch, in accordance with ASTM D256 within temperature range indicated.
19. Notched Izod Impact, Crosswise: 4 ft lbs/inch, in accordance with ASTM D256 within temperature range indicated.

## 2.4 INSULATION

A. See Division 07 for Polyisocyanurate Board Insulation.

## 2.5 ASSEMBLY

A. Assemble composite rainscreen framing system using manufacturer's standard procedures and processes identical to tested units and as necessary to comply with performance requirements indicated.
   1. Comply with framing system and dimensional and structural requirements as indicated on drawings.
   2. Provide moisture weeping, horizontal 7/8" hat channel (where required by system manufacturer, a light gage "Z" may be used in lieu of the hat channel) as indicated between the vertical composite framing and the siding panels as indicated.
   3. Erect framing system in established sequence in accordance with manufacturer's standard installation procedures.
   4. Provide spray foam sealant on backside of cantilevered fasteners that completely puncture insulation layer.

## 2.6 ACCESSORIES

A. Provide accessories necessary for complete composite rainscreen framing system including metal closure trim, transition angle, strapping and similar items.
B. Fasteners: Corrosion-resistant, self-tapping and self-drilling screws, bolts, nuts, and other fasteners as recommended by framing system manufacturer for project application.
   1. Cladding to framing system: Use standard self-tapping metal screws.
   2. Framing system to Metal Stud Wall Framing: Use standard self-tapping metal screws.
   3. DO NOT USE powder, air, or gas actuated fasteners or actuated fastener tools. DO NOT USE impact wrenches when fastening to or from the composite rainscreen framing system.
C. Wall Sheathing: Glass mat faced gypsum, see Section 061600.
D. Weather Resistant Barrier: Refer to Section 072100 for polyisocyanurate board insulation and 072700 for air and vapor barriers and transition membranes.
E. Sealants: Refer to Section 079200 for sealant information.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates, areas of this work, and project conditions with installer present for compliance with requirements for installation tolerances, substrates, framing system conditions, and other conditions affecting performance of this Work.
B. Examine structural wall framing to ensure that angles, channels, studs, and other structural support members have been installed within alignment tolerances required by framing system manufacturer.

C. Examine rough-in for components and systems penetrating framing system to coordinate actual locations of penetrations relative to framing systems joint locations prior to installation.
D. Verify that mechanical and electrical services for exterior walls have been installed and tested and, if appropriate, verify that adjacent materials and finishes are dry and ready to receive insulation.
E. Proceed with installation only after wall substrate surfaces have been properly prepared and unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using methods recommended by framing system manufacturer for achieving best result for substrate under project conditions.
C. Prepare sub-framing, base angles, sills, furring, and other framing system members and provide anchorage in accordance with ASTM C754 for substrate type and wall cladding type in accordance with manufacturer’s installation instructions.

## 3.3 INSTALLATION

A. Install framing system in accordance with manufacturer's installation instructions.
B. Install system to fill-in exterior spaces without gaps or voids, and do not compress insulation panels.
C. Trim insulation neatly to fit spaces and insulate miscellaneous gaps and voids.
D. Fit insulation tight in spaces and tight to exterior side of Mechanical/Electrical services within plane of insulation.
E. Exposed insulation must be protected from open flame.
F. Exterior wall insulation is not intended to be left exposed for extended periods of time without adequate protection.
G. Install framing system in compliance with system orientation, sizes, and locations as indicated on drawings.

## 3.4 TOLERANCES

A. Shim and align framing system within installed tolerances of 1/4 inch in 20 feet, non-cumulative, level, plumb, and on location lines as indicated.

## 3.5 PROTECTION

A. Protect installed products from damage until Date of Final Acceptance.
B. Ensure that insulation panels are not exposed to moisture.
   1. Remove wet insulation panels or allow them to completely dry prior to installation of framing system.
C. Replace damaged insulation prior to Date of Final Acceptance.

**END OF SECTION 07 48 00**

# SECTION 07 54 00 - THERMOPLASTIC MEMBRANE ROOFING

## 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. Adhered membrane roofing system.
B. Related Sections include the following:
   1. Division 06 Section "Rough Carpentry for wood blocking.
   2. Division 05 Section “Steel Decking” for roof deck.
   3. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, counter flashings, gutters and downspouts.
   4. Division 07 Section “Thermal Insulation” for insulation thickness and type.
   5. Division 07 Section "Joint Sealants."
C. Products offered for installation on this project shall have no limitations in their installation or warranty over the roof deck system. Requirements for installations over this deck system which are not indicated in the project drawings or are different from what is shown shall be the responsibility of the roofing installer and shall be included as part of the work of this section.

### 1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.
B. Design Uplift Pressure: Comply with the requirements of Section 1609 NCSBC 2006. In addition, meet the uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," before multiplication by a safety factor. The most stringent requirements shall apply.
C. Factored Design Uplift Pressure: The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," after multiplication by a safety factor.
D. Plywood: A structural board consisting of an odd number of thin layers of wood glued together under pressure, with the grain of one layer at right angles to the grain of the adjoining layer in 5, 7, 9 ply layers as required to achieve the required thickness.

### 1.4 PERFORMANCE REQUIREMENTS

A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

C. Roofing System Design: Provide a membrane roofing system that is designed by an engineer licensed in North Carolina to resist uplift pressure calculated according to ASCE 7.
   1. Zone 1 – 50psf.
   2. Zone 2 – 85psf within 5'-0" of an edge.
   3. Zone 3 – 125psf corner within 5'-0" of edge in each direction.

D. Low sloped roof systems shall be designed and installed for wind loads in accordance with Chpt. 16 of the North Carolina Building Code – latest version and tested for resistance in accordance with ANSI/SPRI ES-1.

## 1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.
   1. Base flashings and membrane terminations.
   2. Tapered insulation, including slopes.
   3. Insulation fastening patterns.

C. Samples for Verification: For the following products:
   1. 12-by-12-inch square of sheet roofing, of color specified, including T-shaped side and end lap seam.
   2. 12-by-12-inch square of roof insulation.
   3. 12-inch length of metal termination bars.
   4. Six insulation fasteners of each type, length, and finish.
   5. Six roof cover fasteners of each type, length, and finish.

D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

E. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
   1. Submit evidence of meeting performance requirements.

F. Qualification Data: For Installer and manufacturer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system.

H. Research/Evaluation Reports: For components of membrane roofing system.

I. Maintenance Data: For roofing system to include in maintenance manuals.

J. Warranties: Special warranties specified in this Section.

K. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

## 1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.

B. Manufacturer Qualifications: A qualified manufacturer that has UL listing for membrane roofing system identical to that used for this Project.

C. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

D. Source Limitations: Obtain components for membrane roofing system roofing membrane manufacturer. All components including but not limited to fascia, gravel stops, copings shall be supplied and warranted as a total roof assembly.

E. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
   1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.

2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.

F. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site. Comply with requirements for preinstallation conferences in Division 01 Section "Project Management and Coordination." Review methods and procedures related to roof deck construction and roofing system including, but not limited to, the following:
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

G. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to roofing system including, but not limited to, the following:
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

## 1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.9 WARRANTY

A. Special Manufacturer's Project Warranty: Non-prorated Warranty, without monetary limitation, in which manufacturer agrees to repair or replace any and all components of membrane roofing system and edge material that fail in materials or workmanship within specified warranty period. Failure includes roof leaks and 120mph blow off. Roof shall be warranted for 120mph wind. All components including but not limited to fascia, gravel stops, copings shall be supplied and warranted as a total roof assembly.
   1. Special warranty includes roofing membrane, base flashings, roofing membrane accessories, roof insulation, fasteners, cover boards, substrate board, vapor retarder, roof pavers, parapets, walkway products, and other components of membrane roofing system.
   2. Warranty Period: 20 years from date of Substantial Completion.

B. Special Contractor/Installers Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer and the Prime Contractor, covering Work of this Section, including all components of membrane roofing system such as roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, parapets and walkway products, for the following warranty period:
   1. Warranty Period: Two years from date of Substantial Completion. All repairs shall be made within 48 hours of notification.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified .

2.2 THERMOPLASTIC POLYOLEFIN ROOFING MEMBRANE

A. Fabric-Reinforced Thermoplastic Polyolefin Sheet: Uniform, flexible sheet formed from a thermoplastic polyolefin, internally fabric or scrim reinforced, and as follows:
   1. Manufacturers:
      a. Carlisle SynTec Incorporated.
      b. Firestone Building Products Company.
      c. GAF Materials Corporation.
      d. Johns Manville International, Inc.
      e. Versico Inc.
      f. GlenFlex Roofing System
   2. Thickness: 60 mils, nominal.
   3. Exposed Face Color: White.

4. Physical Properties:
   a. Solar Reflectance Index (SRI): 78 minimum or higher
   b. Breaking Strength: 250 lbf; ASTM D 751, grab method.
   c. Elongation at Break: 15 percent; ASTM D 751, grab method.
   d. Tearing Strength: 55 lbf minimum; ASTM D 751, Procedure B.
   e. Brittleness Point: Minus -40 deg F.
   f. Ozone Resistance: No cracks after sample, wrapped around a 3-inch- diameter mandrel, is exposed for 166 hours to a temperature of 104 deg F and an ozone level of 100 pphm; ASTM D 1149.
   g. Resistance to Heat Aging: 90 percent minimum retention of breaking strength, elongation at break, and tearing strength after 166 hours at 240 deg F; ASTM D 573.
   h. Water Absorption: Less than 3 percent maximum mass change after 166 hours' immersion at 158 deg F; ASTM D 471.
   i. Linear Dimension Change: Plus or minus 1 percent max; ASTM D 1204.
5. Provide Secure Edge 2000 or 3000 by Carlisle or equal.
6. Installation: Fully Adhered

## 2.3 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing. All components including but not limited to fascia, gravel stops, copings shall be supplied and warranted as a total roof assembly.
B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as PVC sheet membrane.
C. Sheet Flashing: Manufacturer's standard unreinforced thermoplastic polyolefin sheet flashing, **55 mils** thick, minimum, of same color as sheet membrane.
D. Bonding Adhesive: Manufacturer's standard solvent-based bonding adhesive for membrane, and solvent-based bonding adhesive for base flashings.
E. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.
F. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
G. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
H. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories.

## 2.4 COVER BOARD

A. Fiberglass-Mat Faced Gypsum Roof Board:
   a. Thickness: 5/8 inch.
   b. Width: 4 feet.
   c. Length: 8 feet.
   d. Weight: 2.55 lb/sq. ft.
   e. Surfacing: Fiberglass mat with non-asphaltic coating.
   f. Flexural Strength, Parallel (ASTM C473): 100 lbf, minimum.
   g. Flute Span (ASTM E661): 8 inches.
   h. Permeance (ASTM E96): Not more than 32 perms.
   i. R-Value (ASTM C518): Not less than 0.67.
   j. Water Absorption (ASTM C1177): Less than 10 percent of weight.
   k. Compressive Strength (Applicable Sections of ASTM C472): 500 - 900 pounds per square inch.
   l. Surface Water Absorption (ASTM C473): Not more than 2 grams.
2. Acceptable Products:

a. DensDeck Prime, Georgia-Pacific Gypsum or equal

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening substrate panel to roof deck. Fasteners shall be designed to meet all uplift loading conditions. At a minimum, provide (24) fasteners per 4'x8' dimension for the entire roof and (32) fasteners per 4'x8' dimension 4'-0" from the perimeter of the roof.

## 2.5 ACCESSORIES

A. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric mat, water permeable and resistant to ultraviolet degradation, type and weight as recommended by roofing system manufacturer for application. Location as shown on the drawings.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck comply with requirements in Division 05 Section "Steel Decking."
4. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
D. Install acoustical roof deck rib insulation strips, specified in Division 05 Section "Steel Decking," according to acoustical roof deck manufacturer's written instructions.

## 3.3 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.
C. Install tapered insulation under area of roofing to conform to slopes indicated.
D. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 1-1/2 inches 2 inches or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
   1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
   1. Fasten to resist uplift pressure at corners, perimeter, and field of roof. Fasteners shall be installed at a spacing not greater than one fastener per 4 square feet area of roof in the field of the roof and not greater than one fastener per 2 square feet area of roof in the perimeter of the roof.

H. Coordinate with Part 1 "Performance Requirements" Article. Fastener numbers will increase at corners and perimeter over number required for field of roof.

## 3.4 ADHERED ROOFING MEMBRANE INSTALLATION

A. Install roofing membrane over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax 30 minutes before installing.
   1. Install sheet according to ASTM D 5036.

B. Start installation of roofing membrane in presence of membrane roofing system manufacturer's technical personnel.

C. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply solvent-based bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.

E. Adhesively fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.

F. Apply roofing membrane with side laps shingled with slope of roof deck where possible.

G. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.
   1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.
   2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
   3. Repair tears, voids, and lapped seams in roofing membrane that does not meet requirements.

H. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

I. Install roofing membrane and auxiliary materials to tie in to existing roofing.

## 3.5 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply solvent-based bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with sheet flashing.

D. Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

## 3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
   1. Notify Architect or Owner 48 hours in advance of date and time of inspection.

C. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

## 3.7 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.8 ROOFING INSTALLER'S WARRANTY

A. Provide the following Roof Installers Warranty
B. Warranty:

WHEREAS <**Insert name**> of <**Insert address**>, herein called the "Roofing Installer," has performed roofing and associated work ("work" ) on the following project:

Owner: <**Insert name of Owner.**>
Address: <**Insert address.**>
Building Name/Type: <**Insert information.**>
Address: <**Insert address.**>
Area of Work: <**Insert information.**>
Acceptance Date: <**Insert date.**>
Warranty Period: <**Insert time.**>
Expiration Date: <**Insert date.**>

AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

This Warranty is made subject to the following terms and conditions:

Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
lightning;
peak gust wind speed exceeding 146 mph;
fire;
Roofing Installer is responsible for damage to work covered by this Warranty.
Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
This Warranty is not recognized to be the only warranty of Roofing Installer on said work Other warranties are listed in the specifications) and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.
Any litigation shall take place in Onslow County, NC.
This warranty shall not exclude wind damage from hurricanes, damage from hurricanes specifically caused by windborne debris is excluded. Warranty shall include parapets and all roof edge conditions.

IN WITNESS THEREOF, this instrument has been duly executed this <**Insert day**> day of <**Insert month**>, <**Insert year**>.

Authorized Signature: <**Insert signature.**>
Name: <**Insert name.**>
Title: <**Insert title.**>

**END OF SECTION 07 54 00**

# SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes sheet metal flashing and trim in the following categories:
   1. Exposed trim, roof edges and parapet caps.
   2. Metal flashing and counterflashing.
   3. Metal Gutter and Downspouts.

### 1.3 RELATED SECTIONS

A. The following Sections contain requirements that relate to this Section:
   1. Division 04 Section “Unit Masonry” for through-wall flashing and other integral masonry flashings specified as part of masonry work.
   2. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
   3. Coordinate finish and finish colors of work of this section with materials specified in other Division 07 sections.
   4. Division 07 Section "Thermoplastic Membrane Roofing" for flashing and roofing accessories installed integral with and part of roofing-system work.
   5. Division 07 Section “Metal Roof System” for flashing and roofing accessories associated with the metal roof system.
   6. Division 07 Section "Joint Sealants" for elastomeric sealants.

### 1.4 SUBMITTALS

A. Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
B. Product Data including manufacturer's material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product.
C. Shop Drawings of each item specified showing layout, profiles, methods of joining, and anchorage details.
D. Samples of sheet metal flashing, trim, and accessory items, in the specified finish. Where finish involves normal color and texture variations, include Sample sets composed of 2 or more units showing the full range of variations expected.
   1. 8-inch- square Samples of specified sheet materials to be exposed as finished surfaces.
E. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experience Installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
B. Mockups: Prior to installing sheet metal flashing and trim, construct mockups indicated to verify selections made under Sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.
   1. Locate mockups on-site in the location and of the size indicated or, if not indicated, as directed by Architect.
   2. Notify Architect one week in advance of the dates and times when mockups will be constructed.
   3. Demonstrate the proposed range of aesthetic effects and workmanship.
   4. Construct mockups for the following type of sheet metal flashing and trim:
      a. Parapet Cap Assembly.
      b. Exposed trim.
   5. Obtain Architect's approval of mockups before start of final unit of Work.
   6. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
      a. Approved mockups in an undisturbed condition at the time of Final Acceptance may become part of the completed Work.

1.6 PROJECT CONDITIONS

A. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation. Ensure best possible weather resistance, durability of Work, and protection of materials and finishes.
B. Interior and exterior corners of all parapet caps and roof edge flashing assemblies shall be mitered, welded and ground smooth.

PART 2 - PRODUCTS

2.1 METALS

A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability of alloy and temper designated below unless otherwise indicated.
B. Factory-painted Aluminum Sheet: ASTM B 209, 3003-H14, with a minimum thickness of .040" unless indicated otherwise.
C. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   1. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; structural quality.
   2. Surface: Smooth, flat.
   3. Color: As selected by Architect from manufacturer's full range.

2.2 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.

1. Fasteners for Stainless-Steel Sheet: Series 316 stainless steel.
2. Fasteners for Aluminum-Zinc Alloy-Coated Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 316 stainless steel.

B. Asphalt Mastic: SSPC-Paint 12, solvent-type asphalt mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil dry film thickness per coat.

C. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

D. Elastomeric Sealant: Generic type recommended by sheet metal manufacturer and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7 Section "Joint Sealants."

E. Paper Slip Sheet: 5-lb/square red rosin, sized building paper conforming to FS UU-B-790, Type I, Style 1b.

F. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.

## 2.3 FABRICATION, GENERAL

A. Sheet Metal Fabrication Standard: Fabricate sheet metal flashing and trim to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" 7th edition, 2012 that apply to the design, dimensions, metal, and other characteristics of the item indicated.

B. Comply with details shown to fabricate sheet metal flashing and trim that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Form exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.

D. Expansion Provisions: In gutters, space expansion joints as indicated, or if not indicated place as required to provide for one downspouts to be located in any gutter run between expansion joints, with no joints allowed within 24 inches of corners. Fabricate expansion joints in gutters with end caps on both gutter runs, separate gutter runs by 1", cover face of joint with a six inch exposed joint cover, and cap the joint with an exposed cover plate.

E. Lapped or bayonet-type expansion joints are not permitted.

F. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards and as follows:

G. Fabricate sealed joints in prefinished sheet metal with butt joints and concealed splice plates. Install silicone elastomeric sealant between exposed metal work and splice plates, and rivet one side of fabricated unit to splice plate for strength.
   1. Do not use lapped or bayonet-type (nested) joints for sheet metal fabrications.
   2. Fabricate concealed splice plates of specific size and profile to maintain lines and form of fabricated work.
   3. Provide a 1/8" gap between fabricated units at butt joints.

H. Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer.

I. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.

J. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.

K. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

## 2.4 SHEET METAL FABRICATIONS

A. General: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.

B. Exposed Trim and Parapet Caps: Fabricate from the following material:

1. 22 Ga., Metallic Coated Steel Sheet

C. Base Flashing: Fabricate from the following material:
1. 24 Ga., Metallic Coated Steel Sheet

D. Counterflashing: Fabricate from the following material:
1. 24 Ga., Metallic Coated Steel Sheet

## 2.5 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 120-inch- long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA 7th edition, 2012 but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters.
1. Expansion Joints: Butt type with cover plate.
2. Accessories: Wire ball downspout strainer, Valley baffles, Continuous removable leaf screen with sheet metal frame and hardware cloth screen.
3. Gutters, Fabricate from the following materials:
a. Aluminum-Zinc Alloy-Coated Steel Sheet, 24 gauge
b. Exterior Finish: Fluoropolymer two-coat system.
c. Color: As selected by Architect from manufacturer's standard colors.
d. Size: 6” x 8” where indicated in drawings. Slope to downspout.

B. Downspouts: Fabricate downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
1. Fabricated Hanger Style: SMACNA figure designation **1-35C**
2. Fabricate from the following materials:
a. Aluminum-Zinc Alloy-Coated Steel Sheet, 24 gauge
b. Exterior Finish: Fluoropolymer two-coat system.
c. Color: As selected by Architect from manufacturer's standard colors.
d. Size: 4” x 6” where indicated in drawings.

C. Parapet Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, 4-inch-wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof.
1. Fabricate from the following materials:
a. Aluminum-Zinc Alloy-Coated Steel Sheet, 24 gauge
b. Exterior Finish: Fluoropolymer two-coat system.
c. Color: As selected by Architect from manufacturer's standard colors.
d. Size: As indicated in drawings.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that Work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

A. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Anchor units of Work securely in place by methods indicated, providing for thermal expansion

of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Install exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Roof Edge and Parapet Cap Flashings: Secure flashing sat roof edges according to meet all wind load conditions. All roof edge and parapet cap flashing corners shall welded, mitered and ground smooth prior to finishing.

D. Expansion Provisions: In gutters, space expansion joints as indicated, or if not indicated place as required to provide for two downspouts to be located in any gutter run between expansion joints, with no joints allowed within 24 inches of corners. Fabricate expansion joints in gutters with end caps on both gutter runs, separate gutter runs by 1", cover face of joint with a six inch exposed joint cover, and cap the joint with an exposed cover plate.
   1. Lapped or bayonet-type expansion joints are not permitted.

E. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards and as follows:
   1. Fabricate sealed joints in prefinished sheet metal with butt joints and concealed splice plates. Install silicone elastomeric sealant between exposed metal work and splice plates, and rivet one side of fabricated unit to splice plate for strength.
      a. Do not use lapped or bayonet-type (nested) joints for sheet metal fabrications.
   2. Fabricate concealed splice plates of specific size and profile to maintain lines and form of fabricated work.
   3. Provide a 1/8" gap between fabricated units at butt joints.

F. Separations: Separate metal from non-compatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.

G. Install reglets to receive counterflashing according to the following requirements:
   1. Where reglets are shown in masonry, furnish reglets for installation under Division 4 Section "Unit Masonry."

H. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Install counterflashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counterflashing joints a minimum of 2 inches and bed with sealant.

I. Roof-Drainage System: Install drainage items fabricated from sheet metal, with straps, adhesives, and anchors recommended by SMACNA's Manual or the item manufacturer, to drain roof in the most efficient manner. Coordinate roof-drain flashing installation with roof-drainage system installation. Coordinate flashing and sheet metal items for steep-sloped roofs with roofing installation.

J. Roof-Penetration Flashing: Coordinate roof-penetration flashing installation with roofing and installation of items penetrating roof. Install flashing as follows:
   1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
   2. Seal and clamp flashing to pipes penetrating roof, other than lead flashing on vent piping.

## 3.3 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Hanging Gutters: Join sections with riveted or with lapped joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored straps spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant. Slope to downspouts.
   1. Fasten gutter spacers to front and back of gutter.
   2. Anchor back of gutter that extends onto roof deck with cleats spaced not more than **24 inches** apart.

3. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet apart. Install expansion-joint caps.

C. Downspouts: Join sections with 1-1/2-inch telescoping joints.
   1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c. in between.
   2. Provide elbows at base of downspout to direct water away from building.

D. Splash Pans: Concrete splash blocks furnished by the Prime Contractor.

E. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints a minimum of 4 inches in direction of water flow.

## 3.4 CLEANING AND PROTECTION

A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.
   1. Provide final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Final Acceptance.

**END OF SECTION 07 62 00**

# SECTION 07 72 00 - ROOF ACCESSORIES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:
   1. Roof Drainage.
   2. Roof curbs.
   3. Equipment supports.
   4. Roof Vertical Access Ladder.
   5. Roof Walkway mats.
   6. Preformed flashings.

B. Related Sections include the following:
   1. Division 06 Section "Rough Carpentry" for roof sheathing, wood cants, and wood nailers.
   2. Division 07 Section "Sheet Metal Flashing and Trim" for shop- and field-fabricated metal flashing and counterflashing, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.

### 1.3 SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for roof accessories. Show layouts of roof accessories including plans and elevations. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other work.

C. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
   1. Size and location of roof accessories specified in this Section.
   2. Method of attaching roof accessories to roof or building structure.
   3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.

D. Samples: For each type of exposed factory-applied finish required and for each type of roof accessory indicated, prepared on Samples of size to adequately show color.

E. Warranty: Special warranty specified in this Section.

### 1.4 QUALITY ASSURANCE

A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
B. With Architect's approval, adjust location of roof accessories that would interrupt roof drainage routes.

1.8 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: **20** years from date of Final Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers listed in other Part 2 articles.

2.2 METAL MATERIALS

A. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coated and mill phosphatized for field painting.
B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50 coated.
C. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by hot-dip process and prepainted by coil-coating process to comply with ASTM A 755/A 755M.
D. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coated.
E. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coated.
F. Exposed Finishes: High-Performance Organic Finish (2-Coat Fluoropolymer): Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.
   1. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70

percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements

G. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: Cleaned with inhibited chemicals; Chemical Finish: Conversion coating; Organic Coating: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2604 and with coating and resin manufacturer's written instructions.
   1. Color and Gloss: As selected by Architect from manufacturer's full range

H. Steel Tube: ASTM A 500, round tube, baked-enamel finished.

I. Galvanized Steel Tube: ASTM A 500, round tube, hot-dip galvanized to comply with ASTM A 123/A 123M.

J. Galvanized Steel Pipe: ASTM A 53/A 53M.

## 2.3 MISCELLANEOUS MATERIALS

A. Polyisocyanurate Board Insulation: ASTM C 1289, 1 inch thick.

B. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C2; not less than 1-1/2 inches thick.

## 2.4 ROOF DRAINAGE

A. Roof Drain:
   1. Description: Cast iron body with flashing clamp, sump receiver, underdeck clamp, and metal (aluminum or galvanized) dome. Extension required at insulated roofs.

## 2.5 ROOF CURBS

A. Roof Curbs: Provide metal roof curbs, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported on roof curbs. Fabricate with welded or sealed mechanical corner joints, with integral metal cant and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.
   1. Available Manufacturers:
      a. Colony Custom Curbs.
      b. Commodity Products Company, Inc.
      c. Conn-Fab Sales, Inc.
      d. Curbs Plus Inc.
      e. Custom Curb, Inc.
      f. LM Curbs.
      g. Loren Cook Company.
      h. Metallic Products Corporation.
      i. Pate Company (The).
      j. Roof Products & Systems Corporation.
      k. Roof Products, Inc.
      l. Thaler Metal Industries Ltd.
      m. ThyCurb; Div. of Thybar Corporation.
      n. Uni-Curb, Inc.
      o. Vent Products Company, Inc.
   2. Load Requirements: Refer to actual cut sheet for selected product for load requirements.
   3. Material: Aluminum-zinc alloy-coated steel sheet, 0.079 inch
      a. Finish: High-performance organic coating

4. Factory insulate curbs with 1-1/2-inch- glass-fiber board insulation.
5. Curb height may be determined by adding thickness of roof insulation and minimum base flashing height recommended by roofing membrane manufacturer. Fabricate units to minimum height of 12 inches, unless otherwise indicated.
6. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

## 2.6 EQUIPMENT SUPPORTS

A. Equipment Supports: Provide metal equipment supports, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported. Fabricate with welded or sealed mechanical corner joints, with integral metal cant and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.
1. Available Manufacturers:
   a. Colony Custom Curbs.
   b. Commodity Products Company, Inc.
   c. Conn-Fab Sales, Inc.
   d. Curbs Plus Inc.
   e. Custom Curb, Inc.
   f. LM Curbs.
   g. Loren Cook Company.
   h. Metallic Products Corporation.
   i. Pate Company (The).
   j. Roof Products & Systems Corporation.
   k. Roof Products, Inc.
   l. Thaler Metal Industries Ltd.
   m. ThyCurb; Div. of Thybar Corporation.
   n. Uni-Curb, Inc.
   o. Vent Products Company, Inc.
2. Material: Galvanized steel sheet, 0.079 inch thick.
   a. Finish: High-performance organic coating.
3. Factory-install continuous wood nailers 3-1/2 inches wide at tops of equipment supports.
4. Metal Counterflashing: Manufacturer's standard removable counterflashing, fabricated of same metal and finish as equipment support.
5. Fabricate units to minimum height of 12 inches, unless otherwise indicated.
6. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

## 2.7 ROOF VERTICAL ACCESS LADDER

A. Ladder and Safety Post: Manufacturer's standard vertical ladder with over parapet landing and associated vertical ladder, safety post, safety rail, safety chain, & security cage.
1. Height: **Refer to drawings**.
2. Material and Finish: **Aluminum, mill finished**.
3. Diameter: Pipe with **1-5/8-inch** OD tube.

## 2.8 ROOF WALKWAYS

A. Rubber walkway mats where indicated compatible with roof membrane material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.
   1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.
   2. Verify dimensions of roof openings for roof accessories.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.
B. Install roof accessories to fit substrates and to result in watertight performance.
C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
   1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing exposed-to-view components of roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.
   3. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.
D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
E. Roof Curb Installation:
   1. Set roof curb so top surface of roof curb is level.
F. Equipment Support Installation:
   1. Set equipment support so top surface of equipment support is level.
G. Roof Hatch Installation:
   1. Check roof hatch for proper operation. Adjust operating mechanism as required. Clean and lubricate joints and hardware.
   2. Attach safety railing system to roof hatch curb.
   3. Attach ladder safety post according to manufacturer's written instructions.
H. Roof Walkway Installation:
   1. Verify location of points of access to roof-mounted equipment via use of roof walkways.
I. Seal joints with elastomeric sealant as required by manufacturer of roof accessories.

3.3 TOUCH UP

A. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Division 09 Section “Painting”.
B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.4 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

**END OF SECTION 07 72 00**

# SECTION 07 84 13 - PENETRATION FIRESTOPPING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.
B. Related Sections include the following:
   1. Division 07 Section "Joint Firestopping."
   2. Division 22 and 23 Sections specifying duct and piping penetrations.
   3. Division 26, 27, and 28 Sections specifying cable and conduit penetrations.

### 1.3 PERFORMANCE REQUIREMENTS

A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
   1. Fire-resistance-rated walls including fire wall, fire partitions and fire barriers.
B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:
   1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
   1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
   2. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
   3. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

### 1.4 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Qualification Data: For Installer.
C. Product Certificates: For through-penetration firestop system products, signed by product manufacturer.
D. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance.
B. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
   1. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:
      a. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:
         1) UL in its "Fire Resistance Directory."
         2) OPL in its "Directory of Listed Building Products, Materials, & Assemblies."
         3) ITS in its "Directory of Listed Products."
C. Source Limitations: Provide fire-resistive penetration systems, for each kind of penetration and construction condition indicated, through a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.
B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
C. Coordinate firestopping with other trades so that obstructions are not placed in the way prior to the installation of the firestop systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, through-penetration firestop systems that may be incorporated into the Work include, but are not limited to, those systems indicated on Drawings.

2.2 FIRESTOPPING, GENERAL

A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer.

1. Permanent forming/damming/backing materials, including the following:

2.3 FILL MATERIALS

A. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of Part 3 by referencing the types of materials described in this Article. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.

2.4 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

## 3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for firestop systems by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

## 3.4 FIELD QUALITY CONTROL

A. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

B. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

## 3.5 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

## 3.6 THROUGH-PENETRATION FIRESTOP SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to alpha-alpha-numeric designations listed in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Where OPL-classified systems are indicated, they refer to alpha-numeric design numbers in OPL's "Directory of Listed Building Products, Materials, & Assemblies."

C. Where ITS-listed systems are indicated, they refer to design numbers listed in ITS's "Directory of Listed Products," "Firestop Systems" Section.

D. Firestop Systems: Indicated on the drawings.

**END OF SECTION 07 84 13**

# SECTION 07 84 43 – JOINT FIRESTOPPING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes fire-resistive joint systems for the following:
   1. Head-of-wall joints.
   2. Openings between structurally separate sections of walls or floors.
   3. Expansion joints in walls and floors.
   4. Other locations required and/or shown on drawings.

B. Related Sections include the following:
   1. Division 07 Section "Penetration Firestopping" for systems installed in openings in walls and floors with and without penetrating items.
   2. Division 07 Section "Joint Sealants" for non-fire-resistive joint sealants.

### 1.3 PERFORMANCE REQUIREMENTS

A. General: Provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed.

B. Joint Systems in and between Fire-Resistance-Rated Constructions: Provide systems with assembly ratings equaling or exceeding the fire-resistance ratings of construction that they join indicated as determined by UL 2079.

C. For fire-resistive systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

### 1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Certificates: For each type of fire-resistive joint system, signed by product manufacturer.

C. Qualification Data: For Installer.

### 1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide Fire-resistive joint systems that comply with the specified requirements of tested systems.

B. Proposed firestop materials and methods shall conform to applicable governing codes that have jurisdiction.

C. Firestop Systems do not reestablish the structural integrity of load bearing partitions/ assemblies, or support live loads or traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

D. For those firestop applications that exist for which no qualified tested system is available through a manufacturer, an engineering judgment derived from similar qualified tested system design or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment documents must follow requirements set forth by the International Firestop Council
E. Source Limitations: Provide fire-resistive joint systems, for each kind of joint and construction condition indicated, through a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
B. Ventilate fire-resistive joint systems per manufacturer's written instructions by natural means or, if this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
B. Coordinate sizing of joints to accommodate fire-resistive joint systems.
C. Coordinate firestopping with other trades so that obstructions are not placed in the way prior to the installation of the firestop system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, fire-resistive joint systems that may be incorporated into the Work include, but are not limited to, those systems indicated in the Fire-Resistive Joint System Schedule on the Appendix B, located in the Drawing Document Set.

2.2 FIRE-RESISTIVE JOINT SYSTEMS

A. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.
B. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements"

Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of work.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
   1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
   2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.
   4. Comply with manufacturer’s recommendations for temperature and humidity conditions before, during, and after installation of firestopping.

### 3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.
B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
   2. Apply fill materials so they contact and adhere to substrates formed by joints.
   3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
   4. Protect materials from damage on surfaces subjected to traffic.

### 3.4 FIELD QUALITY CONTROL

A. Remove and replace fire-resistive joint systems where inspections indicate that they do not comply with specified requirements.
B. Additional inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and fire-resistive joint systems comply with requirements.

3.5 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to joints as Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which openings occur.
B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.6 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

A. Designation System for Joints in or between Fire-Resistance-Rated Constructions: Alphanumeric systems listed in UL's "Fire Resistance Directory" under Product Category XHBN.
B. Head-of-Wall Fire-Resistive Joint Systems: Refer to drawings for fire resistive joint systems.

**END OF SECTION 07 84 43**

# SECTION 07 92 00 - JOINT SEALANTS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary General Conditions and Division 01 Specification sections, apply to work of this section.

### 1.2 SUMMARY

A. This Section includes joint sealants for the following locations:
B. Exterior joints in vertical surfaces and non-traffic horizontal surfaces as indicated below.
   1. Construction joints in cast-in-place concrete.
   2. Joints between plant-precast architectural concrete units.
   3. Joints between metal panels.
   4. Joints between different materials listed above.
   5. Perimeter joints between materials listed above and frames of doors windows and louvers.
   6. Control and expansion joints in ceilings and other overhead surfaces.
   7. Control and expansion joints in unit masonry.
   8. Perimeter of all doors and windows including aluminum window and doors frames.
   9. Perimeter of all aluminum storefront and curtain wall units.
   10. Between all dissimilar materials unless otherwise shown.
   11. Control joints and expansion joints in gypsum board ceilings.
   12. Other locations as required to keep the building watertight.
   13. Other joints as indicated.
C. Exterior joints in horizontal traffic surfaces as indicated below:
   1. Control and expansion joints in brick pavers.
   2. Joints between plant-precast architectural concrete paving units.
   3. Joints in stone paving units, including steps.
   4. Joints between different materials listed above.
   5. Control, expansion, and isolation joints in cast-in-place concrete slabs for walks and paving.
   6. At all locations where concrete walks abut vertical surfaces including building surfaces and back of curb.
   7. Between all dissimilar materials unless otherwise shown.
   8. Other joints as indicated.
D. Interior joints in vertical surfaces and horizontal nontraffic surfaces as indicated below:
   1. Control and expansion joints on exposed interior surfaces of exterior walls.
   2. Perimeter joints of exterior openings.
   3. Vertical control joints on exposed surfaces of interior unit masonry walls and partitions.
   4. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
   5. Tile control and expansion joints.
   6. Joints between plumbing fixtures and adjoining walls, floors, and counters.
   7. Perimeter joints of toilet fixtures.
   8. Joints between dissimilar materials.
   9. Other joints as indicated.
E. Interior joints in horizontal traffic surfaces as indicated below:
   1. Control and expansion joints in cast-in-place concrete slabs.
   2. Control and expansion joints in tile flooring.
   3. Other joints as indicated.
   4. Between all dissimilar materials unless otherwise shown.

F. Fire-rated joints in vertical and horizontal non-traffic surfaces.
G. Sealants for glazing purposes are specified in Division 08 Section "Aluminum Framed Entrances and Storefront."

## 1.3 RELATED SECTIONS

A. The following Sections contain requirements that relate to this Section:
   1. Division 04 Section "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
   2. Division 07 Section "Joint Firestopping" for sealing joints in fire-resistance-rated construction.
   3. Division 07 Section "Sheet Metal Flashing and Trim" for sealing joints related to flashing and sheet metal for roofing.
   4. Division 08 Section "Glazing" for sealants used in glazing.
   5. Division 09 Section "Gypsum Board" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
   6. Division 09 Section "Tiling" for sealing tile joints.

## 1.4 SYSTEM PERFORMANCES

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
B. Provide joint sealants that have been produced and installed to establish and maintain watertight and airtight continuous seals.

## 1.5 SUBMITTALS

A. Product Data: From manufacturers for each joint sealer product required, including instructions for joint preparation and joint sealer application.
B. Samples: For verification purposes of each type and color of joint sealer required. Install joint sealer samples in ½ inch wide joints formed between two 6 inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
C. Certificates: From manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.
D. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.
E. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.
F. Qualification Data: For Installer.
G. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
   1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
   2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
H. Field Test Report Log: For each elastomeric sealant application.
I. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.
J. Warranties: Special warranties specified in this Section.

## 1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an Installer who has successfully completed within the last 3 years at least 3 joint sealer applications similar in type and size to that of this Project.

B. Single Source Responsibility for Joint Sealer Materials: Obtain joint sealer materials from a single manufacturer for each different product required.
C. Product Testing: Provide comprehensive test data for each type of joint sealer based on tests conducted by a qualified independent testing laboratory on current product formulations within a 24-month period preceding date of Contractor's submittal of test results to Architect.

## 1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
B. Store and handle materials in compliance with manufacturers' recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

## 1.8 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealer manufacturer or below 40 deg F.
   2. When joint substrates are wet due to rain, frost, condensation or other causes.
   3. When conditions are such that wind borne dust, dirt and other debris will contaminate the sealants before they are set and capable of resisting such contamination, unless specific and successful measures can be taken to prohibit such contamination.
B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealer manufacturer for application indicated.
C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

## 1.9 WARRANTY

A. General Warranty: The warranties 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 Installer’s Warranty: Submit a written, non-prorated full warranty, countersigned by the Contractor and the elastomeric sealant Installer agreeing to promptly repair and replace those that leak do not otherwise comply with performance and other requirements specified in this section for the following warranty period:
   1. Warranty Period: Two (2) years from date of Final Acceptance.
C. Special Manufacturer’s Warranty: Submit a written, non-prorated full warranty, signed by the elastomeric sealant manufacturer agreeing to promptly furnish joint sealants to repair and replace those that leak do not otherwise comply with performance and other requirements specified in this section for the following warranty period:
   1. Warranty Period: Ten (10) years from date of Final Acceptance.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, joint fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
B. Colors: Provide color of exposed joint sealants as selected by Architect from manufacturer's standard colors.

2.2 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C 920 requirements, including those referenced for Type, Grade, Class, and Uses.
B. Multi-Part Nonsag Urethane Sealant for Use NT: Type M, Grade NS, Class 25, and complying with the following requirements for Uses:
    1. Uses NT, M, A, and as applicable to joint substrates indicated.
        a. Provide as the general building sealant for all exterior and interior vertical and non-traffic horizontal joints, unless otherwise indicated.
    2. Products: Subject to compliance with requirements, provide one of the following:
        a. Chem-Calk 500; Bostik Construction Products Div.
        b. Vulkem 922; Mameco International, Inc.
        c. Dualthane; W.R. Meadows, Inc.
        d. Dynatrol II; Pecora Corp.
        e. Permapol RC-2; Products Research and Chemical Corp.
        f. Sikaflex-2c NS; Sika Corp.
        g. Sonolastic NP-2; Sonneborn Building Products Div., Rexnord Chemical Products Inc.
        h. Dymeric; Tremco Inc.
C. One-Part Nonsag Urethane Sealant for Use T: Type S, Grade NS, Class 25, and complying with the following requirements for Uses:
    1. Uses T, NT, M, G, A, and, as applicable to joint substrates indicated.
        a. Provide for exterior concrete paving joints, and for exposed interior concrete slab joints, subject to foot or vehicular traffic; and equipment and isolation joints.
    2. Products: Subject to compliance with requirements, provide one of the following:
        a. Chem-Calk 900; Bostik Construction Products Div.
        b. Permapal RC-1; Products Research and Chemical Corp.
        c. Sikaflex-1a; Sika Corp.
        d. Sikaflex-15LM; Sika Corp.
D. One-Part Pourable Urethane Sealant for Use T: Type S, Grade P, Class 25, and complying with the following requirements for Uses:
    1. Uses T, M, A, and, as applicable to joint substrates indicated.
        a. Provide for interior concrete slab joints to receive floor finishes.
    2. Products: Subject to compliance with requirements, provide one of the following:
        a. Chem-Calk 950; Bostik Construction Products Div.
        b. Vulkem 45; Mameco International, Inc.
        c. NR-201 Urexpan; Pecora Corp.
        d. Sonolastic SL-1; Sonneborn Building Products Div., Rexnord Chemical Products Inc.
E. One-Part Nonacid-Curing Silicone Sealant: Type S, Grade NS, Class 25, and complying with the following requirements for Uses and additional joint movement capability:
    1. Uses NT, G, A, and, as applicable to joint substrates indicated.
        a. Additional capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the following percentage changes in joint width

as measured at time of application and remain in compliance with other requirements of ASTM C 920 for Uses indicated:

b. 50% movement in both extension and compression for a total of 100% movement.
c. Provide for flashing and sheet metal joints as required, and elsewhere as indicated.

2. Products: Subject to compliance with requirements, provide one of the following:
   a. Chem-Calk N-Cure 2000; Bostik Construction Products Div.
   b. Dow Corning 790; Dow Corning Corp.
   c. Siliglaze N SCS 2501; General Electric Co.
   d. Silipruf SCS 2000; General Electric Co.
   e. 864; Pecora Corp.
   f. Rhodorsil 5C; Rhone-Poulenc Inc.
   g. Spectrum 1; Tremco Inc.
   h. Spectrum 2; Tremco Inc.

## 2.3 HEAD OF WALL CONDITION (NON-RATED)

A. Location: Provide at all head of wall conditions. This includes existing interior walls and existing exterior walls.
B. Basis of Design: Hilti CFS-SP WB water based acrylic sealant spray or equal.
   1. Color: Provide grey or white. Red will not be accepted since this is a non-rated condition.

## 2.4 JOINT SEALANT BACKING

A. General: Provide sealant backings of material and type which are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
B. Sealant Backer Rod: Provide compressible rod stock of polyethylene foam, polyurethane foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable nonabsorptive material as recommended by sealant manufacturer for back-up of and compatibility with sealant. Where used with hot-applied sealant, provide heat-resistant type which will not be deteriorated by sealant application temperature as indicated.
C. Bond Breaker Tape: Provide polyethylene tape or other plastic tape as recommended by sealant manufacturer, to be applied to sealant-contact surfaces where bond to substrate or joint filler must be avoided for proper performance of sealant. Provide self-adhesive tape where applicable.

## 2.5 MISCELLANEOUS MATERIALS

A. Joint Primer/Sealer: Provide type of joint primer/sealer recommended by sealant manufacturer for joint surfaces to be primed or sealed.
B. Cleaners for Nonporous Surfaces: Provide nonstaining, chemical cleaners of type which are acceptable to manufacturers of sealants and sealant backing materials, which are not harmful to substrates and adjacent nonporous materials, and which do not leave oily residues or otherwise have a detrimental effect on sealant adhesion or in-service performance.
C. Masking Tape: Provide nonstaining, nonabsorbent type compatible with joint sealants and to surfaces adjacent to joints.

## 2.6 JOINT FILLERS FOR CONCRETE PAVING

A. General: Provide joint fillers of thickness and widths indicated.
B. Bituminous and Fiber Joint Filler: Provide resilient and non-extruding type premolded bituminous-impregnated fiberboard units complying with ASTM D 1751; FS HH-F-341, Type I; or AASHTO M 213.

1. Where joints are to receive sealant, provide joint fillers with removable plastic top strips.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealer performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealer manufacturers and the following requirements:
   1. Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer, 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 repellants; water; surface dirt; and frost.
   2. Clean concrete, masonry, unglazed surfaces of ceramic tile and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
   3. Remove laitance and form release agents from concrete.
   4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile; and other nonporous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealer manufacturer based on preconstruction joint sealer-substrate tests or prior experience. Apply primer to comply with joint sealer manufacturer's recommendations. Confine primers to areas of joint sealer bond, do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces which 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 printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Elastomeric Sealant Installation Standard: Comply with recommendations of ASTM C 962 for use of joint sealants as applicable to materials, applications and conditions indicated.

C. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
   1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross- sectional shapes and depths of installed sealants relative to joint widths which allow optimum sealant movement capability.
      a. Do not leave gaps between ends of joint fillers. Bond ends of gaskets together with adhesive of "weld" by other means as recommended by manufacturer to ensure continuous watertight and airtight performance. Miter-cut and bond ends at corners unless molded corner units are provided.
      b. Do not stretch, twist, puncture, or tear joint fillers.

c. Remove absorbent joint fillers which have become wet prior to sealant application and replace with dry material.

2. Install bond breaker tape between sealants and joint fillers, compression seals, or back of joints where adhesion of sealant to surfaces at back of joints would result in sealant failure.

3. Install compressible seals serving as sealant backings to comply with requirements indicated above for joint fillers.

D. Installation of Sealants: Install sealants by techniques, that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.

1. For sidewalks, pavements and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75% of joint width, but neither more than 5/8" deep nor less than 3/8" deep.

2. For normal moving joints sealed with elastomeric sealants but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than ½" deep nor less than 1/4" deep.

3. Install fire-rated sealants or sealants used in fire-rated joints or assemblies in a accordance with manufacturer's recommendations and as acceptable to Code authorities to achieve the required rating.

E. Tooling of Non-sag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

1. Provide concave joint configurations per Figure 6A in ASTM C 962, unless otherwise indicated.

## 3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

## 3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Final Acceptance. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work.

**END OF SECTION 07 92 00**

# SECTION 07 95 13 – INTERIOR EXPANSION CONTROL

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary General Conditions and Division 01 Specification sections, apply to work of this section.

### 1.2 SUMMARY

A. Section includes rated and non-rated expansion joint assemblies for interior floor, wall, and ceiling surfaces, and exterior wall surfaces.
B. Related Sections:
   1. Section 04 “Unit Masonry” for Execution requirements for placement of joint assembly frames specified in this section in masonry.
   2. Section 07 “Sheet Metal Flashing and Trim” Roof control joints.
   3. Section 07 “Joint Sealants”: Expansion and control joint finishing utilizing sealant and bond breaker.

### 1.3 REFERENCES

A. ASTM International:
   1. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   2. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.

### 1.4 SUBMITTALS

A. Shop Drawings: Indicate joint and splice locations, miters, layout of work, affected adjacent construction, and anchorage locations.
B. Product Data: Submit joint assembly profiles, profile dimensions, anchorage devices, and available colors and finish.
C. Samples: Submit two samples 6 inches long, illustrating profile, dimension, color, and finish selected.
D. Manufacturer’s Installation Instructions: Submit rough-in sizes; provide templates for cast-in or placed frames or anchors; required tolerances for item placement.

### 1.5 QUALITY ASSURANCE

A. Verify field measurements are as instructed by manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturers:
   1. MM Systems Corp.
   2. Balco/Metalines.
   3. Construction Specialties, Inc.
   4. Sika
   5. Emseal
   6. Impro
   7. or equal
B. Basis of Design: Impro Corporation, series Jointmaster Expansion Joint System, product 113-A07-025.
C. Width: 2”
D. Location as indicated in drawings.

2.2 COMPONENTS

A. Extruded Aluminum: ASTM B221, 6063 alloy, T5 temper.
B. Threaded Fasteners: Stainless steel.
C. Backing Paint: Asphaltic type.
D. Sealant: Silicone, color to match preformed expansion joint color, or substrate as selected by Architect.
E. Flexible rubber inserts.

2.3 FABRICATION

A. Joint Covers: Aluminum cover plate, designed to permit plus or minus 50 percent joint movement ( unless otherwise noted) with full recovery, surface mounted.
B. Back paint components in contact with cementitious materials.
C. Shop assemble components and package with anchors and fittings.
D. Furnish joint components in single length wherever practical. Minimize site splicing.

2.4 FACTORY FINISHING

A. Floors, Walls and Ceilings: As selected by Architect from manufacturers full range of color coated and anodized finishes. Non-metallic components shall be selected from full range of manufacturers color options.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify joint preparation and affected dimensions are acceptable.

3.2 PREPARATION

A. Provide anchoring devices for installation and embedding.
B. Provide templates and rough-in measurements.

3.3 INSTALLATION

A. Install per manufacturer's recommendations.
B. Align work plumb and level, flush with adjacent surfaces. Perform all cutting, assembling and fitting required for installation of expansion joint covers
C. Rigidly anchor to substrate to prevent misalignment. Install joint cover assemblies in true alignment and proper relationship to expansion joints and adjoining finished surfaces measured from established lines and levels. Securely attach in place with all required accessories. Locate anchors at recommended intervals, and not less than 3 inches from each end.
D. Maintain continuity of expansion joint cover assemblies with end joints held to a minimum. Lengths of profiles with one-piece anchorage unit are connected with the help of slide-in connecting pins. Lengths of profiles with two-piece anchorage units are connected by staggering the aluminum profiles.
E. Apply field sealant to joint material, compatible with adjacent material, both sides of joint unless otherwise directed.

**END OF SECTION 07 95 13**

# SECTION 07 95 16 – EXTERIOR EXPANSION CONTROL

## PART 1 – GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary General Conditions and Division 01 Specification sections, apply to work of this section.

### 1.2 WORK INCLUDED

A. The work shall consist of furnishing and installing waterproof expansion joints in accordance with the details shown on the plans and the requirements of the specifications. Preformed sealant shall be performed, pre-compressed, self-expanding, sealant system.

### 1.3 RELATED WORK

A. The following Sections contain requirements that relate to this Section:
   1. Division 04 – Unit Masonry.
   2. Division 07 – Joint Sealants.

### 1.4 SUBMITTALS

A. Standard Submittal Package – Submit typical expansion joint drawing(s) indicating pertinent dimensions, general construction, expansion joint opening dimensions and product information.
B. Sample of material is required at time of submittal.
C. Product must be certified by independent laboratory test report to exceed the requirements of curtain wall performance tests ASTM E330, E283-04, and E331. Product must meet or exceed hurricane-force wind loading with no deflection at both positive and negative pressures up to 4954 Pascals - equal to 200 mph winds (ASTM E330-02 procedure A).
D. Product must be certified by independent laboratory test report to meet or exceed STC 56 in an STC 72 wall and OITC 53 in an OITC 61 wall in accordance with ASTM E90-09.
E. All products shall be certified in writing to be:
   1. Capable of withstanding 150°F (65°C) for 3 hours while compressed down to the minimum of movement capability dimension of the basis of design product (-25% of nominal material size) without evidence of any bleeding of impregnation medium from the material.
   2. That the same material after the heat stability test and after first being cooled to room temperature will subsequently self-expand to the maximum of movement capability dimension of the basis-of-design product (+25% of nominal material size) within 24 hours at room temperature 68°F (20°C).

### 1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver products to site in Manufacturer's original, intact, labeled containers. Handle and protect as necessary to prevent damage or deterioration during shipment, handling and storage. Store in accordance with manufacturer's installation instructions.

1.6 QUALITY ASSURANCE

A. The General Contractor will conduct a pre-construction meeting with all parties and trades involved in the treatment of work at and around expansion joints including, but not limited to, concrete, mechanical, electrical, HVAC, landscaping, masonry, curtain wall, waterproofing, fire-stopping, caulking, flooring and other finish trade subcontractors. All superintendents and foremen with responsibility for oversight and setting of the joint gap must attend this meeting.
B. The General Contractor is responsible to coordinate and schedule all trades and ensure that all subcontractors understand their responsibilities in relation to expansion joints and that their work cannot impede anticipated structural movement at the expansion joints, or compromise the achievement of water tightness or life safety at expansion joints in any way.
C. Installer Qualifications: Engage an Installer who has successfully completed within the last 3 years at least 3 joint sealer applications similar in type and size to that of this Project.
D. Single Source Responsibility for Joint Sealer Materials: Obtain joint sealer materials from a single manufacturer for each different product required.

1.7 WARRANTY

A. Manufacturer's standard warranty shall apply.

1.8 PERFORMANCE REQUIREMENTS:

A. Products must be proved to be certified by independent test report to exceed the requirements of curtain wall performance tests ASTM E330, E283, and E331. Product must meet or exceed hurricane-force wind loading with no deflection at both positive and negative pressures up to 4954 Pascals—equal to 200 mph winds (ASTM E330-02-procedure A).
B. Products must be proved to have been certified by independent test report in accordance with ASTM C518-04 and demonstrate an R-Value per 1-inch (25mm) of depth of not less than 1.8 at as-installed nominal joint size compression.
C. Products must be proved to have been certified by independent test report to ASTM E-90-09 and to meet or exceed an STC rating of 56 and OITC rating of 53
D. Product must be proved by independent test report to have air permeability not to exceed 0.02 L/(s.m2) at 75 Pascals as required by the Air Barrier Association of America (ABAA) in accordance with ASTM E283-04.

PART 2 - PRODUCT

2.1 GENERAL

A. Provide watertight, energy-efficient exterior and interior joints in vertical-plane walls (above-grade). Typical locations include, but are not limited to the following: applications in window perimeters, other façade penetrations such as doors, store fronts, vents, HVAC units, panel to panel joints, curtain walls, control joints, between dissimilar materials, and new-to-existing connections.
B. Preformed sealant shall be preformed, pre-compressed, self-expanding, sealant system. Expanding foam to be cellular foam impregnated with a water-based, non-drying, polymer-modified 100% acrylic dispersion. Seal shall combine factory-applied, low-modulus silicone and a backing of acrylic-impregnated expanding foam into a unified hybrid sealant system.
C. Material shall be capable of movements of +25%, -25% (50% total) of nominal material size.
D. Silicone external color facing to be factory-applied to the foam while it is partially pre-compressed to a width greater than maximum joint extension and cured before final compression. When compressed to final supplied dimension, a bellow(s) to handle movement must be created in the silicone coating.

Silicone coating to be available in a range of not less than 26 standard colors for coordination with typical building materials.

E. Expansion Joint to be installed recessed from the substrate faces and to receive a field-applied coating of low-modulus liquid sealant (by others) not to exceed ¼ inch, (6mm) thick.
F. Expansion Joint to be installed at depth sufficient to allow installation of properly sized backer rod and liquid sealant (by others) in front of material.
G. Select the sealant system model appropriate to the movement and design requirements at each joint location that meet the project specification or as defined by the structural engineer of record.
H. Manufacturer's Checklist must be filled out by expansion joint subcontractor and returned to manufacturer at time of ordering material.

## 2.2 JOINT SYSTEM

A. Basis of Design: Provide Emseal Expansion Joints and Precompressed sealants, product Seismic Colorseal, Erie Metal Specialties or equal. Location as indicated on drawings for vertical expansion joint locations.
B. All products shall be designed to meet the specified performance criteria of the project as manufactured by: Emseal.
C. Approved manufacturers must demonstrate that their products meet or exceed the design criteria and must submit certified performance test reports performed by nationally recognized independent laboratories as called for in section 1.4 Submittals.
    1. Subject to meeting requirements provide basis of deign or equals by Sika, BASF or Tremco
D. Width: 2"

## 2.3 FABRICATION

A. Expansion Joint must be supplied precompressed to less than the joint size, packaged in reels or shrink-wrapped lengths (sticks) with a mounting adhesive on one face.
B. Directional changes and terminations into horizontal plane surfaces to be provided by factory-manufactured universal-90-degree single units containing minimum 12-inch long leg and 6-inch long leg or custom leg on each side of the direction change or through field fabrication in strict accordance with installation instructions.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Preparation of the Work Area
B. The contractor shall provide a properly formed and prepared expansion joint openings constructed to the exact dimensions and elevations shown on shown on the contract drawings. Deviations from these dimensions will not be allowed without the written consent of the engineer of record.
C. The contractor shall clean the joint opening of all contaminants immediately prior to installation of expansion joint system. Repair spalled, irregular or unsound joint surfaces using accepted industry practices for repair of the substrates in question. Remove protruding roughness to ensure joint sides are smooth. Ensure that there is sufficient depth to receive the full depth of the size of the COLORSEAL being installed. Refer to Manufacturers Installation Guide for detailed step-by-step instructions.
D. No drilling, or screwing, or fasteners of any type are permitted to anchor the system into the substrate.

3.2 CLEAN AND PROTECT

A. Protect the system and its components during construction. Subsequent damage to the expansion joint system will be repaired at the general contractor's expense. After work is complete, clean exposed surfaces with a suitable cleaner that will not harm or attack the finish.

**END OF SECTION 07 95 16**

# SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:
   1. Standard hollow metal doors and frames.
B. Related Sections:
   1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
   2. Division 08 Section "Door Hardware" for door hardware for hollow metal doors.
   3. Division 08 Section “Glazing” for hollow metal doors and frames.
   4. Division 09 Sections "Painting" for field painting hollow metal doors and frames.
   5. Division 26 Sections for electrical connections including conduit and wiring for door controls and operators.

### 1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.
B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

### 1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.
B. Shop Drawings: Include the following:
   1. Elevations of each door design.
   2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.
   5. Details of each different wall opening condition.
   6. Details of anchorages, joints, field splices, and connections.
   7. Details of accessories.
   8. Details of conduit and preparations for power, signal, and control systems.
   9. Submit schedule of doors and frames using same reference numbers for details and openings as those on Contract Drawings.
      a. Indicate coordination of glazing frames and stops with glass and glazing requirements.
C. Other Action Submittals:
   1. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.
B. Fire-Rated Door Assemblies: Assemblies 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 or UL.
   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 above ambient after 30 minutes of standard fire-test exposure.
C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are 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. Label each individual glazed lite.
D. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- high wood blocking. Do not store in a manner that traps excess humidity.
   1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.
D. Inspect doors and frames on delivery for damage. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect; otherwise, remove and replace damaged items as directed.

1.7 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Amweld Building Products, LLC.
   2. Ceco Door Products; an Assa Abloy Group company.
   3. Curries Company; an Assa Abloy Group company.
   4. Pioneer Industries, Inc.
   5. Steelcraft; an Ingersoll-Rand company.
   6. Deansteel Manufacturing

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.
D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z 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. Fabricated from not less than 0.0478-inch- thick steel sheet; 0.0516-inch- thick galvanized steel where used with galvanized steel frames.
E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M class C or D as applicable.
F. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
G. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
H. Glazing: Comply with requirements in Division 08 Section "Glazing."

2.3 STANDARD HOLLOW METAL DOORS

A. General: Provide 1 ¾ inch thick doors of materials and ANSI/SDI 100 grades and models specified below or as indicated on drawings or schedules. Fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
   1. Design: Flush panel.
   2. Core Construction: Manufacturer's standard polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
      a. Fire Door Core: As required to provide fire-protection ratings indicated.
      b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 6.0 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
         1) Locations: Exterior doors and interior doors where indicated.
   3. Vertical Edges for Single-Acting Doors: Manufacturer's standard.
      a. Beveled Edge: 1/8 inch in 2 inches.
   4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick, end closures or channels of same material as face sheets.
   5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
   1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless), .0635 inch (16 gauge) thick galvanized steel sheet faces, foam insulated.
C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
   1. Level 2 and Physical Performance Level B (Heavy Duty), Model 2 (Seamless), minimum .0478 inch (18 gauge) thick cold rolled steel sheet faces. Provide for all interior Hollow Metal Doors as scheduled unless otherwise noted.

2. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless), .0635 inch (16 gauge) thick galvanized steel sheet faces. Provide at Hollow Metal doors where scheduled on drawings.
    a. Provide at the following Doors: 1040, 1045, 1050, 1055.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

E. Fabricate concealed continuous stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Fire Rating: Supply door units bearing Labels for fire ratings indicated in Door Schedule for the locations indicated.

## 2.4 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile. Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, according to ANSI/SDI 100, and of types and styles as shown on drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames of minimum 16-gauge thick cold-rolled steel sheet.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.
1. Fabricate frames with mitered or coped corners and continuously welded corners.
2. Fabricate frames of minimum 14-gauge thick cold-rolled steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.
1. Fabricate frames with mitered or coped corners and continuously welded corners.
2. Fabricate frames of minimum 16-gauge thick cold-rolled steel sheet.
3. Fabricate frames of minimum 14-gauge thick cold-rolled steel sheet.
    a. Provide at the following Doors: 1040, 1045, 1050, 1055.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

E. Fabricate frames as indicated in door schedule with an integral kerf and fire approved Seals.

F. **Plaster Guards:** Provide minimum 0.0179-inch- thick steel plaster guards or mortar boxes at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.

G. Fire Rating: Supply frame units bearing Labels for fire ratings indicated in Door Schedule for the locations indicated.
1. Manufacturers shall provide the type of fire door and frame assembly that has been investigated and/or successfully fire tested in accordance with the latest revision of ANSI/UL10B, “Fire Tests of Door Assemblies”, ANSI/UL10C, “Positive Pressure Fire Tests of Door Assemblies”, or ANSI/NFPA 252, “Fire Tests of Door Assemblies.” The assembly shall be identified by labels and/or an approved identification marking of an agency accepted by the authority having jurisdiction. The door label shall indicate the applicable fire test rating for the door construction furnished.

## 2.5 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.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

## 2.6 HOLLOW METAL PANELS

A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

## 2.7 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.
B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.
C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

## 2.8 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

## 2.9 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
B. Internal Construction: One of the following manufacturer's standard core materials according to SDI standards:
    1. Rigid polystyrene core (required for all exterior doors).
    2. Rigid mineral fiber with internal sound deadener on inside of face sheets.
    3. Clearances: Not more than 1/8 inch at jambs and heads, except not more than 1/4 inch between non-fire-rated pairs of doors. Not more than 3/4 inch at bottom.
    4. Fire Doors: Provide clearances according to NFPA 80.
    5. Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from only cold-rolled steel sheet.
    6. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.
C. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
D. Hollow Metal Doors:
    1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
    2. Glazed Lites: Factory cut openings in doors.
    3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
E. Galvanized Steel Doors, Panels, and Frames: For the following locations, fabricate doors, panels, and frames from galvanized steel sheet according to SDI 112. Close top and bottom edges of doors flush as an integral part of door construction. Seal joints in top edges of doors against water penetration.
    1. At exterior locations.
    2. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.
    3. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C 236 or ASTM C 976 on fully operable door assemblies.

a. Unless otherwise indicated, provide thermal-rated assemblies with U-value rating of 0.24 Btu/sq. ft. x h x deg F or better.

4. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.

F. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Sidelight and Transom Bar 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.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. Jamb Anchors: Provide number and spacing of anchors as follows:
   a. Masonry 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) 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 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

G. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

H. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised and concealed hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
2. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

I. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints. Minimum 0.0359-inch- thick steel or 0.040-inch- thick aluminum.

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 screw applied removable stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

## 2.10 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.11 GALVANIZED STEEL SHEET FINISHES:

A. Surface Preparation: Clean surfaces with non-petroleum solvent so that surfaces are free of oil or other contaminants. After cleaning, apply a conversion coating of the type suited to the organic coating applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
   1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.

B. Factory Priming for Field-Painted Finish**:** Where field painting after installation is indicated, apply air-dried primer specified below immediately after cleaning and pretreatment.
   1. Shop Primer: Zinc-dust, zinc-oxide primer paint complying with performance requirements of FS TT-P-641, Type II.

2.12 STEEL SHEET FINISHES:

A. Surface Preparation: Solvent-clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel to comply with SSPC-SP 5 (White Metal Blast Cleaning) or SSPC-SP 8 (Pickling).
   1. Pretreatment: Immediately after surface preparation, apply a conversion coating of type suited to organic coating applied over conversion coating.

B. Factory Priming for Field-Painted Finish: Apply shop primer that complies with ANSI A224.1 acceptance criteria, is compatible with finish paint systems indicated, and has capability to provide a sound foundation for field-applied topcoats. Apply primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
   1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.

3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

## 3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
   a. Except for frames located in existing concrete, masonry, or gypsum board assembly construction, place frames before constructing enclosing walls and ceilings.
   b. In masonry construction, install at least 3 wall anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
   c. In metal-stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In steel-stud partitions, attach wall anchors to studs with screws.
   d. At fire-protection-rated openings, install frames according to NFPA 80.
   e. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
   f. Install frames with removable glazing stops located on secure side of opening.
   g. Install door silencers in frames before grouting.
   h. Remove temporary braces necessary for installation only after frames have been properly set and secured.
   i. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
   j. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
   a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
4. 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 Standard Steel Doors:
   a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
   b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
   c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.

d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches 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. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

**END OF SECTION 08 11 13**

# SECTION 08 14 16 - FLUSH WOOD DOORS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:
   1. Solid-core doors with wood-veneer faces.
   2. Factory fitting flush wood doors to frames and factory machining for hardware.
B. Related Sections:
   1. Division 08 Section "Glazing" for glass view panels in flush wood doors.

### 1.3 SUBMITTALS

A. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.
B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
   1. Indicate dimensions and locations of mortises and holes for hardware.
   2. Indicate dimensions and locations of cutouts.
   3. Indicate requirements for veneer matching.
   4. Indicate doors to be factory finished and finish requirements.
   5. Indicate fire-protection ratings for fire-rated doors.
C. Samples for Initial Selection: For factory-finished doors
   1. Veneer samples for doors with transparent finish. Provide one set of veneer samples of the species indicated, showing the full range of color or grain variation anticipated.
      a. Provide samples showing factory stain and factory transparent finish.
D. 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 the finished work.
   2. Louver blade and frame sections, 6 inches long, for each material and finish specified.
   3. Frames for light openings, 6 inches long, for each material, type, and finish required.
E. Warranty: Sample of special warranty.

### 1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors from single manufacturer.
B. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."
   1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.

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 or UL.
   1. Doors to be category “A” with integral Intumescent to meet IBC2000 positive pressure requirements.
   2. Temperature-Rise Limit: Where indicated, 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.

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.
B. Package doors individually in plastic bags or cardboard cartons
C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

## 1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period as required in AWI quality standard Section 100-S-11 "Relative Humidity and Moisture Content.".

## 1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
      b. 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.
B. General Warranty: Door manufacturer's 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.

# 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. Algoma Hardwoods, Inc.
   2. Eggers Industries.
   3. Weyerhauser, Co.
   4. Mohawk Flush Doors, Inc.; a Masonite company.
   5. VT Industries Inc.
   6. Oshkosh Door Company
   7. Lambton Doors

2.2 DOOR CONSTRUCTION, GENERAL

A. Particleboard-Core Doors:
1. Particleboard: ANSI A208.1, Grade LD-1 or Grade LD-2.
2. Blocking: Provide wood blocking in particleboard-core doors as follows:
a. 5-inch top-rail blocking, in doors indicated to have closers.
b. 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
c. 5-inch midrail blocking, in doors indicated to have exit devices.
d. 5-inch lock blocks.
e. Block as required for manual or automatic flush bolts.
3. Provide doors with either glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

B. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
1. Faces and Grade: Provide faces and grade to match non-fire-rated doors in same area of building, unless otherwise indicated.
2. Construction: Manufacturer's standard core construction as required to provide fire-resistance rating indicated.
3. Blocking: Provide composite blocking as required designed to maintain fire resistance of door but with improved screw-holding capability of same thickness as core and with minimum dimensions as follows:
a. 5-inch top rail blocking.
b. 5-inch bottom rail blocking.
c. 5-by-18-inch lock blocks.
d. 5-inch midrail blocking.
e. Blocking as required for manual or automatic flush bolts.
4. Edge Construction: Provide manufacturer's standard laminated-edge construction for improved screw-holding capability and split resistance as compared to edges composed of a single layer of treated lumber. Edge to be applied after beveled core resulting in a seamless edge appearance.
5. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
6. Pairs: 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.

C. 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. Faces and Grade: Provide faces and grade to match non-fire-rated doors in same area of building, unless otherwise indicated.
3. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as follows:
a. 5-inch top-rail blocking.
b. 5-inch bottom-rail blocking, in doors indicated to have protection plates.
c. 5-inch midrail blocking, in doors indicated to have armor plates.
d. 5-inch midrail blocking, in doors indicated to have exit devices.
4. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:
1. Grade: Premium, with Grade A faces.
2. Species: Clear Select White Maple
3. Cut: Plain sliced

4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Running match.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Exposed Vertical Edges: Same species as faces.
8. Core: Particleboard: ANSI A208.1
   a. Provide door core rated for the fire rating indicated in the door schedule.
9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.
10. WDMA I.S.1-A Performance Grade: Heavy Duty.
11. Fire Rating: Supply door units bearing Labels for fire ratings indicated in Door Schedule for the locations indicated.

## 2.4 LIGHT FRAMES

A. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

## 2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
   1. Comply with requirements in NFPA 80 for fire-rated doors.
B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
   1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
   2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
C. Openings: Cut and trim openings through doors in factory.
   1. Light Openings: Trim openings with moldings of material and profile indicated.
   2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing."
   3. Louvers: Factory install louvers in prepared openings.

## 2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
   1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
B. Finish doors at factory.
C. Transparent Finish:
   1. Grade: Premium Custom.
   2. Finish: AWI conversion varnish or catalyzed polyurethane.
   3. Staining: As selected by Architect from manufacturer's full range.
   4. Effect: Filled finish.
   5. Sheen: Semigloss.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.
   1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 08 Section "Door Hardware."
B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
   1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
   1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
      a. Comply with NFPA 80 for fire-rated doors.
   2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
   3. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.
D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
E. Factory-Finished Doors: Restore finish before installation if fitting / machining is required at Project site.
   1. Factory Finish doors to comply with AWI finish TR6 (AWI #5) and provide stain color as selected by Architect. Factory finishing shall comply with Section 1500 AWI – Latest Edition. Provide 12"X12" door samples with final stain and finish selection. Doors shall match final approved sample.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.
B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

**END OF SECTION 08 14 16**

# SECTION 08 31 13 - ACCESS DOORS AND FRAMES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:
   1. Access doors and frames for ceilings.
B. Related Sections include the following:
   1. Division 09 Section "Gypsum Board" for suspended gypsum board ceilings.

### 1.3 SUBMITTALS

A. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.
C. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.
D. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

### 1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.
B. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

### 1.5 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

## PART 2 - PRODUCTS

### 2.1 STEEL MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Steel Sheet: electrolytic zinc-coated, ASTM A 591/A 591M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

C. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.
3. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils. Prepare, treat, and coat metal to comply with resin manufacturer's written instructions.

D. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

## 2.2 ACCESS DOORS AND FRAMES FOR CEILINGS

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. Acudor Products, Inc.
2. Babcock-Davis; A Cierra Products Co.
3. Bar-Co, Inc. Div.; Alfab, Inc.
4. Cendrex Inc.
5. Dur-Red Products.
6. Elmdor/Stoneman; Div. of Acorn Engineering Co.
7. Jensen Industries.
8. J. L. Industries, Inc.
9. Karp Associates, Inc.
10. Larsen's Manufacturing Company.
11. MIFAB, Inc.
12. Milcor Inc.
13. Nystrom, Inc.
14. Williams Bros. Corporation of America (The).

B. Flush Access Doors and Trimless Frames: Fabricated from steel sheet.
1. Locations: Wall and ceiling surfaces.
2. Door: Minimum **0.060-inch** thick sheet metal, set flush with surrounding finish surfaces.
3. Frame: Minimum 0.060-inch thick sheet metal with drywall bead flange.
4. Hinges: Continuous piano.
5. Latch: Cam latch operated by screwdriver with interior release.

## 2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
1. For trimless frames with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.
B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.
B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

**END OF SECTION 08 31 13**

# SECTION 08 33 13 – COILING COUNTER DOORS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:
   1. Manual counter doors.
B. Related Sections:
   1. Division 05 Section "Metal Fabrications" for miscellaneous steel supports.
   2. Division 06 Section “Rough Carpentry” for door opening jamb and head members.
   3. Division 09 Section "Painting" for finish painting of factory-primed doors.

### 1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design overhead coiling doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
B. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
C. Provide doors with Underwriters' Laboratories, Inc. label for the fire rating classification where indicated.

### 1.4 SUBMITTALS

A. Product Data: For each type and size of rolling door and accessory. Include the following:
   1. Construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
   1. Include similar Samples of accessories involving color selection.
D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Curtain Slats: 12 inches long
   2. Bottom Bar: 6 inches long with sensor edge.
   3. Guides: 6 inches long.
   4. Brackets: 6 inches square.
   5. Hood: 6 inches square.
E. Qualification Data: For qualified Installer.
F. Maintenance Data: For rolling doors to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
B. Source Limitations: Obtain rolling doors from single source from single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packaging supplied by manufacturer with intact labels. Store materials away from harmful environmental conditions and construction.

1.7 WARRANTY

A. Standard Warranty: Two years from Final Completion against defects in material and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Cornell
   2. The Cookson Company
   3. Amarr
   4. Clopay
   5. Raynor
   6. Wayne-Dalton
   7. Or equal
B. Basis of Design
   1. Exterior, Insulated: Cornell ERC10
   2. Interior: Cornell ESC10
C. Finish: Clear Anodized

2.2 MATERIALS

A. Curtain:
   1. Slat Configuration:
      a. Exterior, Insulated:
         1) Aluminum: No. 1F, interlocked flat-faced slats, 1-1/2 inches (38 mm) high by 1/2 inch (13 mm) deep, minimum 0.040 inch aluminum with extruded tubular aluminum bottom bar with continuous lift handle and vinyl astragal. Gray PVC backer slat.
         2) Insulation: 3/8 inch (9.5 mm) open cell melamine
         3) Total Slat Thickness: .545 inch (13.8 mm)
         4) Flame Spread Index of 15 and a Smoke Developed Index of 450 as tested per ASTM E84
         5) R Value: 2.0
         6) U-Factor: .88
         7) STC Rating: Up to 26 for the entire assembly, as tested per ASTM E90 and based on testing a complete, operable assembly.

b. Interior:
1) Aluminum: No. 1F, interlocked flat-faced slats, 1-1/2 inches (38 mm) high by 1/2 inch (13 mm) deep, minimum 0.040 inch aluminum with extruded tubular aluminum bottom bar with continuous lift handle and vinyl astragal.

2. Finish: Clear Anodized

B. Endlocks: Fabricate continuous interlocking slat sections with high strength endlocks riveted to slat ends per UL requirements.

C. Head and Jamb Frame:
1. Integral welded with guide groove incorporated into jamb design. Build to fit wall thickness.

D. Counterbalance Shaft Assembly:
1. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot of width.
2. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will not exceed 25 lbs. Provide wheel for applying and adjusting spring torque.

E. Brackets: Fabricate from reinforced steel plate with bearings at rotating support points to support counterbalance shaft assembly and form end closures for hood.
1. Finish:
a. Phosphate treatment followed by a baked-on polyester powder coat; minimum 2.5 mils cured film thickness. Powder coat to match finish.

F. Hood: 0.040 inch aluminum with reinforced top and bottom edges. Provide minimum 1/4 inch steel intermediate support brackets as required to prevent excessive sag.
1. Finish:
a. To Match Curtain.

G. Smoke Seals & UL Smoke Label:
1. Where UL requirement indicated:
a. Bottom Bar: UL tested brush seal.
b. Guides and Head: Replaceable, UL Listed, brush seals sealing against fascia side of curtain

## 2.3 OPERATION

A. Manual Push-Up Operation: Conventional spring tension release operating system
1. Provide bottom bar lift handles and a pull-down pole with hook.
2. Activate automatic closure by melting of a fusible link.
3. Maintain automatic closure speed at an average of 6” – 24” per second.
4. Reset of spring tension, mechanical dropouts or release devices to be completed only by an approved and trained door systems technician.
5. Drop test and reset door system twice by all means of activation and comply fully with NFPA 80, Section 5.

## 2.4 ACCESSORIES

A. Locking:
1. Padlockable slide bolt: Padlockable slide bolt on coil side of bottom bar at each jamb extending into slots in guides.

B. Countertop:
1. Stainless steel min. 14 gauge type 304 #4 finish: 1 ½ Hour UL Labeled, 2” (51 mm) thick, 14 gauge type 304 #4 finish stainless steel. “T” shaped design for face of wall mounted unit of size and configuration for opening size and wall construction

C. Graphic Door Image:
1. Decal Graphics: Flat face surface of door curtain slats to include a factory applied 4 color process, 2 mil thick vinyl graphic image, 3M□ or equal. Graphic image to be selected and electronically supplied by customer. (No width limit; Max. height: 10 ft.)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
B. Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings.
C. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.
D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install door unit and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
B. Follow manufacturer's installation instructions.

3.3 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
B. Lubricate bearings and sliding parts as recommended by manufacturer.
C. Following completion of installation, including related work by others, lubricate, test, and adjust doors for ease of operation, free from warp, twist, or distortion.

3.4 CLEANING

A. Clean surfaces soiled by work as recommended by manufacturer.
B. Remove surplus materials and debris from the site.

3.5 DEMONSTRATION

A. Demonstrate proper operation to Owner's Representative.
B. Instruct Owner's Representative in maintenance procedures.

**END OF SECTION 08 33 13**

# SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:
   1. Exterior manual-swing entrance doors and door-frame units.
   2. Exterior windows (fixed glass)
   3. Interior windows and door-frame units.

B. Related Sections:
   1. Division 08 Section "Louvers And Vents" for units installed with aluminum-framed systems.
   2. Division 08 Section “Glazing” for glazing with frames.

### 1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
   1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
   2. Dimensional tolerances of building frame and other adjacent construction.
   3. Failure includes the following:
      a. Deflection exceeding specified limits.
      b. Thermal stresses transferring to building structure.
      c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
      d. Noise or vibration created by wind and by thermal and structural movements.
      e. Loosening or weakening of fasteners, attachments, and other components.
      f. Sealant failure.

B. Structural Loads:
   1. Wind Loads: Provide aluminum entrance and storefront assemblies for wind loading of 150 mph (ASCE 7-98) and capable of withstanding minimum wind pressures of 40 psf inward and 40 psf outward acting normal to the plane of the wall.
      a. Basic Wind Speed: **146 mph**.
   2. Other structural data: See sheet **G0-01, G0-02, & G0-03**, Structural Design, and Structural Drawings.

C. Deflection of Framing Members:
   1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed L/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 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 directly below them to less than 1/8 inch and clearance between members and operable units directly below them to less than 1/16 inch.

D. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:
   1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
   2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
   3. Test Durations: As required by design wind velocity, but not fewer than 10 seconds.

E. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft..

F. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..

G. Water Penetration under Dynamic Pressure: Provide aluminum-framed systems that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..
   1. Maximum Water Leakage: No uncontrolled water penetrating aluminum-framed systems or water appearing on systems' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters that is drained to exterior and water that cannot damage adjacent materials or finishes.

H. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
   2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
      a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
      b. Low Exterior Ambient-Air Temperature: 0 deg F.
   3. Interior Ambient-Air Temperature: 75 deg F.

I. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.

J. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.57 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.

K. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by aluminum-framed systems without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
   1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
   2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.

L. Structural-Sealant Joints: Designed to produce tensile or shear stress of less than 20 psi.

## 1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
   1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Other Action Submittals:
   1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

E. Delegated-Design Submittal: For aluminum-framed systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Detail fabrication and assembly of aluminum-framed systems.
   2. Include design calculations.

F. Qualification Data: For qualified Installer.

G. Seismic Qualification Certificates: For aluminum-framed systems**,** accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.

I. Quality-Control Program for Structural-Sealant-Glazed System: Include reports.

J. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

K. Warranties: Sample of special warranties.

## 1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
   Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

B. Preconstruction Sealant Testing: For structural-sealant-glazed systems, perform sealant manufacturer's standard tests for compatibility with and adhesion of each material that will come in contact with sealants and each condition required by aluminum-framed systems.
   1. Test a minimum five samples each of metal, glazing, and other material.
   2. Prepare samples using techniques and primers required for installed systems.
   3. For materials that fail tests, determine corrective measures necessary to prepare each material to ensure compatibility with and adhesion of sealants including, but not limited to, specially formulated primers. After performing these corrective measures on the minimum number of samples required for each material, retest materials.

C. Accessible Entrances: Comply with applicable provisions NCSBC 2012 and ICC/ANSI A117.1-2009.

D. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

E. Structural-Sealant Glazing: Comply with ASTM C 1401, "Guide for Structural Sealant Glazing" for design and installation of structural-sealant-glazed systems.

F. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.

G. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

H. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of typical wall area as shown on Drawings.
   2. Field testing shall be performed on mockups according to requirements in "Field Quality Control" Article.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

I. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration caused by thermal movements.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      d. Adhesive or cohesive sealant failures.
      e. Water leakage through fixed glazing and framing areas.
      f. Failure of operating components.
   2. Warranty Period: **Five** years from date of Final Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.
   1. Warranty Period: **10** years from date of Final Completion.

1.8 MAINTENANCE SERVICE

A. Entrance Door Hardware:
   1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Designs indicated on the Drawings are based on YKK series products. Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. EFCO Corporation.
   2. Kawneer North America; an Alcoa company.
   3. Old Castle Building Envelope
   4. YKK AP America Inc.
   5. Tubelite Inc.

2.2 EXTERIOR STOREFRONT FRAMING SYSTEMS

A. Storefront Frames: Basis of Design YKK YES 45 TU
   1. Description: Thermally broken center set storefront framing system for insulating glass
   2. Size: 2” x 4 ½”
   3. Flush glazed from the exterior with 1” insulated glazing
   4. Provide integral entrance door frames at locations show in drawings

5. Frame to be Thermally broken
6. Provide as indicated on the drawings.

## 2.3 INTERIOR STOREFRONT FRAMING SYSTEMS

A. Storefront Frames: Basis of Design YKK YES 45 FS
   1. Description: Thermally broken center set storefront framing system for insulating glass
   2. Size: 1 ¾" x 4 ½"
   3. Flush glazed from the exterior with 1" insulated glazing
   4. Provide integral entrance door frames at locations show in drawings
   5. System designed primarily for ¼" glass or infill panels from ¼" to 3/8".
   6. Provide as indicated on the drawings.

## 2.4 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Sheet and Plate: ASTM B 209.
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
   3. Extruded Structural Pipe and Tubes: ASTM B 429.
   4. Structural Profiles: ASTM B 308/B 308M.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
   1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

## 2.5 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-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: Center.

B. Provide for flush glazing storefront from the exterior on all sides without projecting stops. Shop-fabricate and preassemble frame components where possible. Provide storefront frame sections without exposed seams.
   1. Mullion Configurations: Provide pockets at the inside glazing face to receive resilient elastomeric glazing.
   2. Mullions and horizontals shall be one piece. Make provisions to drain moisture accumulation to the exterior

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components. Provide high-strength aluminum brackets and reinforcements; where use of aluminum is not feasible provide nonmagnetic stainless steel or hot-dip galvanized steel complying with ASTM A 123.

D. 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, fabricated from stainless steel.

E. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M.
F. Concealed Flashing: Dead-soft, 0.018-inch (26 gauge) thick stainless steel or .026-inch thick minimum extruded aluminum alloy and type selected by manufacturer for compatibility with other components, ASTM A 240/A 240M of type recommended by manufacturer.
G. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

## 2.6 GLAZING SYSTEMS

A. Glazing: As specified in Division 08 Section "Glazing."
B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.
C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

## 2.7 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard, glazed entrance doors for manual-swing operation.
   1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
   2. Door Design: Wide stile; 5-inch nominal width. Provide 6” side stile width top and mid rail with 10” bottom rail width.
      a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.
   3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
      a. Provide non-removable glazing stops on outside of door.
B. Entrance Door Hardware: As specified in Division 08 Section "Door Hardware."

## 2.8 ENTRANCE DOOR HARDWARE

A. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door to comply with requirements in this Section.
   1. Entrance Door Hardware Sets: Coordinate with Division 08, Section “Door Hardware” for hardware furnished under that section. (Coordinate factory hardware templates and finishes.)
   2. Sequence of Operation: Coordinate with Division 08, Section “Door Hardware”. Provide for electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
   3. Opening-Force Requirements:
      a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion and not more than 15 lbf to open the door to its minimum required width.
      b. Accessible Interior Doors: Not more than 5 lbf to fully open door.
B. Opening-Force Requirements:
   1. Delayed-Egress Locks: Lock releases within 15 seconds after applying a force of not more than 15 lbf for not more than 3 seconds.
   2. Latches and Exit Devices: Not more than 15 lbf required to release latch.
C. Weather Stripping: Manufacturer's standard replaceable components.
   1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
D. Weather Sweeps: Manufacturer's standard exterior-door bottom drip cap and sweep with concealed fasteners on mounting strip.
E. Silencers: BHMA A156.16, Grade 1.

2.9 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section "Joint Sealants."
B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil thickness per coat.

2.10 FABRICATION

A. General:
   1. Form or extrude aluminum shapes before finishing.
   2. Fabricate aluminum entrance and storefront components to designs, sizes and thicknesses indicated and to comply with indicated standards. Sizes and profile requirements are indicated on the drawings. Variable dimensions are indicated, with maximum and minimum dimensions required, to achieve design requirements and coordination with other work.
      a. Thermal-Break Construction: Fabricate storefront framing system with an integrally concealed, low-conductance thermal barrier, located between exterior materials and exposed interior members to eliminate direct metal-to-metal contact. Use manufacturer's standard construction that has been in use for similar projects for period of not less than 3 years.
   3. Complete fabrication, assembly, finishing, hardware application, and other work to the greatest extent possible before shipment to the Project site. Disassemble components only as necessary for shipment and installation.
   4. Perform fabrication operations, including cutting, fitting, forming, drilling and grinding of metal work to prevent damage to exposed finish surfaces. Complete these operations for hardware prior to application of finishes.
   5. Do not drill and tap for surface-mounted hardware items until time of installation at project site.
B. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fitted joints with ends coped or mitered.
   3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
   4. Physical and thermal isolation of glazing from framing members.
   5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   6. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
   7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
C. Reinforcing:
   1. Install reinforcing as required for hardware and as necessary for performance requirements, sag resistance and rigidity.
   2. Provide closer reinforcing at header.
   3. Provide exit device strike reinforcing at jamb.
D. Storefront Framing: Fabricate components for assembly using shear-block system.
E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
   1. At exterior doors, provide compression weather stripping at fixed stops.
F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
   1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
   2. At exterior doors, provide weather drip caps & sweeps applied to door bottoms.
G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. Dissimilar Metals: Separate dissimilar metals with bituminous paint, or a suitable sealant, or a nonabsorptive plastic or elastomeric tape, or a gasket between the surfaces. Do not use coatings containing lead.
I. Continuity: Maintain accurate relation of planes and angles with hairline fit of contacting members.
   1. Uniformity of Metal Finish: Abutting extruded aluminum members shall not have an integral color or texture variation greater than half the range indicated in the sample pair submittal.
J. Fasteners: Conceal fasteners wherever possible.
K. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

## 2.11 ALUMINUM FINISHES

A. Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
B. Color: Clear

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

A. General:
   1. Comply with manufacturer's written instructions.
   2. Do not install damaged components.
   3. Fit joints to produce hairline joints free of burrs and distortion.
   4. Rigidly secure nonmovement joints.
   5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
   6. Seal joints watertight unless otherwise indicated.
B. Metal Protection:
   1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
   2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
   3. Zinc or cadmium plate steel anchors and other unexposed fasteners after fabrication.
C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
D. Set continuous sill members and flashing in full sealant bed as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.
E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.
F. Drill and tap frames and doors and apply surface-mounted hardware items. Comply with hardware manufacturer's instructions and template requirements. Use concealed fasteners wherever possible.
G. Install glazing as specified in Division 08 Section "Glazing."
   1. Structural-Sealant Glazing:

a. Prepare surfaces that will contact 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.
b. Install weatherseal sealant according to Division 07 Section "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.
c. Set sill members and other members in bed of sealant as indicated, or with joint fillers or gaskets as indicated to provide weathertight construction. Comply with requirements of Division 07 for sealants, fillers, and gaskets.

H. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

I. Install perimeter joint sealants as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

## 3.3 ERECTION TOLERANCES

A. Install aluminum-framed systems to comply with the following maximum erection tolerances:
1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
2. Alignment:
a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

## 3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections.

B. Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.

C. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

## 3.5 FINAL CLEANING / ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.
1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

B. Cleaning: Clean the completed system, inside and out, promptly after installation, exercising care to avoid damage to coatings.Clean glass surfaces after installation, complying with requirements contained in the "Glass and Glazing" Section for cleaning and maintenance. Remove excess glazing and sealant compounds, dirt and other substances from aluminum surfaces.

C. Protection: Institute protective measures required throughout the remainder of the construction period to ensure that aluminum entrances and storefronts will be without damage or deterioration, other than normal weathering, at time of acceptance.

3.6 ENTRANCE DOOR HARDWARE SETS: See Division 08, “Door Hardware”.

**END OF SECTION 08 43 13**

# SECTION 08 45 00 – TRANSLUCENT WALL AND ROOF ASSEMBLIES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:
   1. Translucent wall system.
B. Related Sections:
   1. Division 05 Section "Metal Fabrications" for misc. steel.
   2. Division 06 Section "Rough Carpentry" for wood framing and blocking at unit skylights.
   3. Division 07 Section "Sheet Metal Flashing and Trim" for flashing at unit skylights.
   4. Division 07 Section “Joint Sealants” for sealant.

### 1.3 PERFORMANCE REQUIREMENTS

A. Performance Requirements:
   1. Framing Members: Sufficient sizes as required to support design loads.
B. Design Loads: Framing components shall be designed to support following loads:
   1. Live Load:
      a. As indicated on the Drawings. Refer to G0-10 for Building Code Summary.
   2. Wind Load:
      a. Wind Speed: **146mph**
      b. Exposure Category: **B**
      c. As indicated on the Drawings. Refer to G0-10 for Building Code Summary.
C. Deflection of a Framing Member in a Direction Normal to Plane of Glazing: Shall not exceed L/100.
D. Safety Factors: Allowable stresses shall incorporate following safety factors, unless otherwise specified:
   1. Load Carrying Members: 1.65.
   2. Load Carrying Fasteners: 2.0.
E. Expansion and Contraction: Design and install components with provisions for expansion and contraction due to a 100 degree F (56 degrees C) temperature variation.
F. AAMA/WDMA Performance Designation: Provide unit capable of complying with performance requirements indicated, based on testing.

### 1.4 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Maintenance instructions.
B. Shop Drawings: Include plans, elevations, sections, and details, indicating dimensions, tolerances, profiles, anchorage, connections, fasteners, provisions for expansion and contraction, drainage, flashing, finish, glazing, and attachments to other Work.

C. Design Data:
   1. Submit manufacturer's structural calculations showing sizes of framing members and loads applied to supporting structure based on design loads.
   2. Structural calculations shall be prepared in accordance with Aluminum Association Specifications for Aluminum Structures SAS30 by a professional engineer licensed in the State of North Carolina qualified in design of self-supporting, sloped glazed systems and curtainwall systems and licensed in state where skylights and wall systems are to be installed.

D. Test Reports: Submit certified test reports from a qualified independent testing agency, indicating skylights and wall systems comply with specified requirements, based on testing of current products. Submit results from the following tests:
   1. Flame spread and smoke development, ASTM E 84.
   2. Burn extent, ASTM D 635.
   3. Color change, ASTM D 2244 in accordance with ASTM D 1435.
   4. Impact strength, exterior face sheets, UL 972.
   5. Accelerated aging, ASTM D 1037.
   6. Bond strength, ASTM C 297.
   7. Insulating U-factor, ASTM C 236.
   8. Self-ignition, ASTM D 1929.
   9. Class A burning brand, ASTM E 108.
   10. Air infiltration, ASTM E 283.
   11. Water penetration, ASTM E 331.
   12. Uniform load deflection, ASTM E 72 and E 330.
   13. Concentrated and Impact, ASTM E 661.
   14. Certification authorization under the NFRC PCP (Framing and Panel).

E. Selection Samples: For each finish product and glazing material specified, two complete sets of color chips representing manufacturer's full range of available colors and finishes.

F. Verification Samples: For each finish product and glazing material specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

G. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

H. Warranty: Sample of special warranty.

## 1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer to have minimum ten years documented experience in the fabrication of skylights and wall systems of the type required for this project and be capable of providing field service representation during installation.

B. Installer Qualifications: Installer to have minimum five years documented experience in the work of this section who has specialized in the installation of work similar to that required for this project and is approved by the manufacturer.

C. Preinstallation Meeting: Convene a Preinstallation meeting 2 weeks before start of installation of skylights and wall systems. Require attendance of parties directly affecting work of this section, including Contractor, Architect, installer, and manufacturer's representative. Review requirements for preparation, installation, cleaning, protection, and coordination with other work.

D. 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, and color are approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

E. Source Limitations: Obtain unit from single source from single manufacturer.

## 1.6 COORDINATION

A. Coordinate unit flashing requirements with other associated trades.

B. Coordinate sizes and locations with actual field conditions and openings.

C. Provide anchors and inserts to be placed in adjacent construction in proper sequence so as not to delay the Work.
D. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.
E. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.
F. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

## 1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of units that fails in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Uncontrolled water leakage.
      b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      c. Yellowing of acrylic glazing.
      d. Breakage of polycarbonate glazing.
      e. Deterioration of insulating-glass hermetic seal.
   2. Warranty Period: **Five** years from date of Final Acceptance.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. American Skylites.
   2. APC Dayliter; C/S Group.
   3. Auburn Skylights; Major Industries, Inc.
   4. Bristolite Skylights.
   5. CPI International.
   6. Dur-Red Products.
   7. Exarc Skylights, Inc.
   8. Fiore Skylights, Inc.
   9. Fox Lite, Inc.; Skymaster Skylights.
   10. GE Polymer Shapes; General Electric Company.
   11. Glazed Structures Inc.
   12. Hi Pro International, Inc.
   13. Kalwall Corporation.
   14. Lane-Aire Manufacturing Corp.
   15. Naturalite Skylight Systems; Vistawall Group (The).
   16. Plasteco, Inc.
   17. Plastic Engineering Company of Tulsa, Inc.
   18. Skyline Sky-Lites, LLC.
   19. Solar Industries, Inc.
   20. Sunglo Skylight Products.
   21. VELUX America.
   22. Wasco Products, Inc.

## 2.2 TRANSLUCENT SKYLIGHTS AND WALL SYSTEMS

A. Translucent Wall Systems:
1. Design Wind Load: As indicated in the drawings.
2. Panel Height:
   a. Estimated at 6’-0”.
   b. Verify Dimensions in Field.
3. Panel Width:
   a. Estimated at 20’-4”.
   b. Verify Dimensions in Field.
4. Sizing: Refer to drawings.

## 2.3 MATERIALS

A. Translucent Panel Units:
1. Construction: Translucent facings of ICC ES Listed architectural-grade fiberglass reinforced polymer sheets bonded under controlled heat and pressure to a mechanically-interlocked aluminum I-beam grid core framework to form double-faced, self-supporting, structural composite, sandwich panels.
   a. Thickness: 2-3/4 inches
   b. Overall Dimensions: As indicated in the drawings.
   c. U-Factor: When tested in accordance with ASTM C 236 and AAMA 1503.1, 2 mph:
      1) 0.40.
   d. Grid Pattern:
      1) In-line Shoji.
      2) Symmetrical about horizontal and vertical center lines of panel.
   e. Nominal Grid Size:
      1) 12 inches by 24 inches.
   f. Unbonded Areas: Maximum of 4 unbonded areas, a maximum of 3/64 inch in diameter, in an area a maximum of 40 square feet of panel surface.
   g. Panel Weeps: Weep holes provided on down slope side for skylights or bottom side of wall systems of installed panels to permit condensation to leave panel interior.
   h. Panel Corners: Notch and interlock or reinforce with aluminum angle for radius conditions.
   i. Assembly: Factory assembled and factory sealed when allowable. Field assembly of major components will not be allowed.
2. Physical Properties:
   a. Burning Brand, ASTM E 108: Class A rating.
   b. Aged Adhesive Bond Strength, ASTM D 1037:
   c. Shear Strength, ASTM D 1002: 1212 psi.
   d. Tensile Strength, ASTM C 297: 914 psi.
   e. Uniform Load Deflection, ASTM E 72 and E 330: Maximum deflection of L/100.
   f. Concentrated and Impact, ASTM E 661.
   g. Air Infiltration Through Fixed Panel System and Perimeter Framing, ASTM E 283: 0.04 cfm/ft of panel perimeter at 15 psf air pressure (77 mph constant wind).
   h. Water Penetration Through Fixed Panel System and Perimeter Framing, ASTM E 331: No leakage when water is applied to entire panel surface at rate of 5 gal/hr/sq ft for 15 minutes (8 inch per hour rainfall) at 15 psf air pressure (77 mph constant wind).
3. I-Beam Grid Core:
   a. Material: Aluminum Alloy 6061-T6 or equivalent.
   b. Flange Width: 7/16 inch minimum.
   c. Web Thickness: 0.050 inch.
   d. Mechanically interlocked. Mechanically interlocked I-Beam Grid Core Acceptable.
   e. Full surface contact with face sheets.

f. Welded or web interlocked grid core will not be acceptable due to unevenness at muntin-mullion intersections.
g. Thermal Break:
1) Located in panel grid core.
2) Continuous, insulating U-Factor of 0.5.
3) FRP thermal breaks less than 1" will not be acceptable.

4. Adhesive:
a. Laminate Adhesive: Waterproof resin for use in laminating polyester sheet to aluminum grid core.
b. Impact and Thermal Shock: Adhesive capable of withstanding impact and thermal shock normally encountered in exterior construction.
c. Adhesive Bond Line: Straight, black, cover entire width of I-beam, with neat, sharp edge.
d. Initial Bond Strength Between Face Sheet and Grid Core, ASTM C 297: 557 psi minimum.
e. After Accelerated Aging, ASTM D 1037: No significant change in bond strength, ASTM C 297.

5. Thermal Barriers:
a. Perimeter Framing System: Continuous, insulating U-Factor of 0.5.
b. Screw-applied thermal barriers will not be acceptable. Clamp and/or crimp installation acceptable.

6. Translucent Face Sheets
a. Appearance of Face Sheets:
1) Uniform in color to prevent splotchy appearance.
2) Free of ridges and wrinkles that prevent proper surface contact for bonding to grid core.
3) Free of clusters of air bubbles and pinholes that collect moisture and dirt.
4) ICC-ES listed face sheet (ER 2026).
b. Exterior Face Sheet:
1) Darkening, ASTM D 2244: Not darken more than 3.0 Delta E units after 5 years of outdoor weathering in South Florida at 45 degrees facing south.
2) Protective Weathering Surface:
a) Material: "State-of-the-art" surface protection.
b) Application: Factory-applied.
c) Minimum Thickness: 1.0 mil.
d) Repairs: Fully field repairable.
3) Impact Strength, UL 972:
a) 60 foot-pounds.
4) Thickness:
a) 0.070 inches (1.77 mm).
5) Color:
a) Crystal.
c. Interior Face Sheet:
1) Flame Spread, ASTM E 84: 20 maximum.
2) Smoke Development, ASTM E 84: 150 maximum.
3) Burn Rate, ASTM D 635: 1.0 inch per minute maximum.
4) Self-Ignition, ASTM D 1929: Greater than 650 degrees F.
5) Thickness:
a) 0.045 inches.
6) Color:
a) Crystal.

B. Framing Materials
1. Aluminum:
a. Extruded Aluminum: ASTM B 221, Alloy 6063-T5/T6, 6061-T5/T6, or equivalent.
b. Formed Aluminum Components and Flashing: ASTM B 209, Alloy 5005-H34 or equivalent.
c. Minimum Thickness: 0.040 inch.

d. Construct of extruded aluminum shapes similar to sections indicated on the Drawings.

2. Interior Glazing Gaskets:
   a. Extruded closed cell sponge neoprene hybrid, 9/16 inch wide.
   b. Factory installed in extruded dovetail slots.
   c. Compression Deflection, 25 Percent Deflection Limits, ASTM D 1056: 13 to 24 psi.
   d. Compression Set, 22 Hours at 158 Degrees F, Maximum Percent, ASTM D 395, Method B: 30 psi.
   e. Heat Aging, 70 Hours at 212 Degrees F, Change in Compression Values, ASTM D 865 and D 1056: 0 to 10 psi.
   f. Dimensional Stability, Change Maximum Percent After Heat Aging, 70 Hours at 212 Degrees F, 4 Psi: 11.4 percent.
   g. Ozone Resistance at 40 Percent Elongation, 100 Hours at 104 Degrees F, ASTM D 1149:
      1) Type I, 1 Ppm Ozone: No cracks.
      2) Type II, 3 Ppm Ozone: No cracks.
   h. Water Absorption, Percent of Weight:
      1) Option I: 5.0 percent.
      2) Option II: 11.7 percent.
   i. Flame Propagation:
      1) Option I, 4 Inch Maximum: 11.7 percent.
      2) Option II, No Limit: 11.8 percent.
   j. Straining of Surface, ASTM D 925: Nonstraining, no migratory strain.

C. Condensation Control System:
   1. Mechanically design entire condensation control system to function properly with minimal dependency upon sealants.

D. Custom Designs:
   1. Perform fitting and assembly of custom designs at factory, insofar as practicable.
   2. Completely assemble, mark, and disassemble components which cannot be permanently factory assembled, before delivery to site to ensure proper assembly in field.

E. Expansion and Contraction: Design and install components with provisions for expansion and contraction due to a 100 degree F temperature variation.

F. Glazing Caps:
   1. Extruded aluminum.
   2. Attach glazing caps with glazing cap fasteners located at a maximum of 9 inches on center or as required to resist negative loading.

G. Fasteners:
   1. Clips for Attachment of Rafter Bars:
      a. Aluminum.
      b. Attach using bolted fastening methods.
   2. Construction and Glazing Cap Fasteners:
      a. 18-8 stainless steel.
      b. Include gasketed sealing washers.
   3. Field Anchors: Cadmium plated, unless otherwise specified.
   4. Exposed Fasteners: Finish to match aluminum.

H. Welding:
   1. Heliarc welding process.

I. Weep Holes in Sill Components: Located as required to control condensation that may enter system by allowing it to pass to exterior.

J. Wall System Baffles: Provide with baffled weep holes to prevent water infiltration due to unequal pressures.

## 2.4 ALUMINUM FINISHES

A. Anodized Coating: Architectural Class I clear anodized, Type AA-M10C22A41.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.
B. Examine areas to receive translucent skylights and wall systems, with installer and manufacturer's representative present, including supporting structure and substrate for dimensions, tolerances, material conditions, and support.
C. Notify Architect of conditions that would adversely affect installation or subsequent utilization of skylights and wall systems. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.
B. Ensure supports to receive skylights and wall systems are clean, flat, level, plumb, and square.
C. Aluminum Protection: Apply a protective coating of bituminous paint or other neutral material to dissimilar materials coming in contact with aluminum or separate with a nonabsorbent isolator.

3.3 INSTALLATION

A. Install translucent skylights and wall systems in accordance with manufacturer's instructions at locations indicated on the Drawings.
B. Install skylights and wall systems level, plumb, square, accurately aligned, correctly located, and without warp or rack.
C. Do not install skylight components with deficiencies or dimensional errors. Do not proceed with installation until unsatisfactory components are replaced.
D. Anchor skylights and wall systems securely in place to supports. Use attachment methods permitting adjustment for construction tolerances, irregularities, alignment, and expansion and contraction.
E. Install skylights and wall systems including flashings, fasteners, hardware, sealants, and glazing materials required for a complete, weatherproof installation.
F. Repair damages to protective weathering surface of exterior face sheet in accordance with manufacturer's instructions and as approved by Architect.

3.4 FIELD QUALITY CONTROL

A. Water Test: Test skylights and wall systems according to procedures in AAMA 501.2.
B. Repair or replace work that does not pass testing or that is damaged by testing and retest work.
C. Inspect installation of sheet metal flashing and sealants.
D. Inspect face sheets for cracks, deep scratches, and other damage.

3.5 CLEANING

A. Clean installed skylights and wall systems in accordance with manufacturer's instructions.
B. Clean skylights and wall systems inside and outside, including member connections and inside corners, immediately after installation and after sealants have cured.
C. Remove temporary protective coverings and strippable coatings from prefinished metal surfaces.
D. Remove labels and part number markings from components.
E. Do not use harsh cleaning materials or methods that would damage metal finishes or glazing.

3.6 PROTECTION

A. Protect installed products until completion of project.
B. Touch-up, repair or replace damaged products before Final Acceptance.

**END OF SECTION 08 45 00**

# SECTION 08 71 00 – DOOR HARDWARE

## PART 1 - GENERAL

### 1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware
2. Electronic access control system components

B. Section excludes:

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

C. Related Sections:

1. Division 01 Section “Alternates” for alternates affecting this section.
2. Division 06 Section “Rough Carpentry”
3. Division 06 Section "Finish Carpentry”
4. Division 07 Section “Joint Sealants” for sealant requirements applicable to threshold installation specified in this section.
5. Division 08 Sections:

    a. “Metal Doors and Frames”
    b. “Flush Wood Doors”

6. Division 09 sections for touchup, finishing or refinishing of existing openings modified by this section.
7. Division 26 “Electrical” sections for connections to electrical power system and for low-voltage wiring.
8. Division 28 “Electronic Safety and Security” sections for coordination with other components of electronic access control system and fire alarm system.

### 1.02 REFERENCES

A. UL, LLC

1. UL 1784 - Air Leakage Tests of Door Assemblies
2. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code
2. NFPA 101 – Life Safety Code

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

## 1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:

   a. Comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, “EXAMINATION” article, herein.
   b. Review drawings and Sections from related trades to verify compatibility with specified hardware.
   c. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:

   a. Wiring Diagrams: For power, signal, and control wiring and including:
      1) Details of interface of electrified door hardware and building safety and security systems.
      2) Schematic diagram of systems that interface with electrified door hardware.
      3) Point-to-point wiring.
      4) Risers.

3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.

   a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule:

   a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.

b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
c. Indicate complete designations of each item required for each opening, include:
   1) Door Index: door number, heading number, and Architect's hardware set number.
   2) Quantity, type, style, function, size, and finish of each hardware item.
   3) Name and manufacturer of each item.
   4) Fastenings and other pertinent information.
   5) Location of each hardware set cross-referenced to indications on Drawings.
   6) Explanation of all abbreviations, symbols, and codes contained in schedule.
   7) Mounting locations for hardware.
   8) Door and frame sizes and materials.
   9) Degree of door swing and handing.
   10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.

5. Key Schedule:

   a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
   b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
   c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
   d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
   e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
   f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

C. Informational Submittals:

1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
2. Provide Product Data:

   a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
   b. Include warranties for specified door hardware.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:

   a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
   b. Catalog pages for each product.
   c. Final approved hardware schedule edited to reflect conditions as installed.
   d. Final keying schedule
   e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

E. Inspection and Testing:

1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:

a. required egress door assemblies, in compliance with NFPA 101.

## 1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:

a. For door hardware: DHI certified AHC or DHC.
b. Can provide installation and technical data to Architect and other related subcontractors.
c. Can inspect and verify components are in working order upon completion of installation.
d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.

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

B. Certifications:

1. Electrified Door Hardware

a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

2. Accessibility Requirements:

a. Comply with governing accessibility regulations cited in "REFERENCES" article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.

C. Pre-Installation Meetings

1. Keying Conference

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

2. Pre-installation Conference

    a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
    b. Inspect and discuss preparatory work performed by other trades.
    c. Inspect and discuss electrical roughing-in for electrified door hardware.
    d. Review sequence of operation for each type of electrified door hardware.
    e. Review required testing, inspecting, and certifying procedures.
    f. Review questions or concerns related to proper installation and adjustment of door hardware.

3. Electrified Hardware Coordination Conference:

    a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

## 1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer’s original packaging.

C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.

D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

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

## 1.06 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.

1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.

    a. Mechanical Warranty
        1) Locks
            a) 3 years
        2) Exit Devices
            a) 3 years
        3) Closers
            a) 30 years
        4) Automatic Operators
            a) 2 years

    b. Electrical Warranty
        1) Exit Devices
            a) 1 year

1.07 MAINTENANCE

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

B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

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

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

2.02 MATERIALS

A. Fabrication

1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer's recognized installation standards for application intended.

2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with “Metal Doors and Frames” and “Flush Wood Doors” to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.

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

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

C. Cable and Connectors:

1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.
2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.
3. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

## 2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. Ives 5BB series

2. Acceptable Manufacturers and Products:

a. Hager BB1191/1279 series
b. Stanley FBB series

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Provide five knuckle, ball bearing hinges.
3. Provide hinge weights and sizes as specified in hardware sets.
4. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
5. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
6. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

a. Steel Hinges: Steel pins
b. Non-Ferrous Hinges: Stainless steel pins
c. Out-Swinging Exterior Doors: Non-removable pins
d. Out-Swinging Interior Lockable Doors: Non-removable pins
e. Interior Non-lockable Doors: Non-rising pins

## 2.04 CONTINUOUS HINGES

A. Manufacturers:

1. Scheduled Manufacturer:

   a. Ives

2. Acceptable Manufacturers:

   a. Select
   b. ABH

B. Requirements:

1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
6. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
7. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

## 2.05 ELECTRIC POWER TRANSFER

A. Manufacturers:

1. Scheduled Manufacturer and Product:

   a. Von Duprin EPT-10

2. Acceptable Manufacturers and Products:

   a. ABH PT1000
   b. Security Door Controls PTM

B. Requirements:

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

## 2.06 FLUSH BOLTS

A. Manufacturers:

1. Scheduled Manufacturer:

    a. Ives

2. Acceptable Manufacturers:

    a. Burns
    b. DCI

B. Requirements:

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

## 2.07 MORTISE LOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

    a. Schlage L9000 series

2. Acceptable Manufacturers and Products:

    a. Sargent 8200 series
    b. Corbin-Russwin ML2000 series

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.
2. Indicators: Where specified, provide indicator window measuring a minimum 2-inch x 1/2 inch with 180-degree visibility. Provide messages color-coded with full text and/or symbols, as scheduled, for easy visibility.
3. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
4. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to “KEYING” article, herein.
5. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.

    a. Lever Design: 06A.

## 2.08 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

    a. Von Duprin 98/35A series

2. Acceptable Manufacturers and Products:

    a. Detex Advantex series
    b. Precision APEX 2000 series

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to “KEYING” article, herein.
3. Provide smooth touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
6. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
7. Provide flush end caps for exit devices.
8. Provide exit devices with manufacturer’s approved strikes.
9. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
10. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
11. Provide cylinder dogging as specified at non fire-rated openings.
12. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
13. Provide electrified options as scheduled.
14. Top latch mounting: double- or single-tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
15. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

## 2.09 POWER SUPPLIES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

    a. Schlage/Von Duprin PS900 series

2. Acceptable Manufacturers and Products:

    a. Dynalock 5000 series
    b. Security Door Controls 600 series

B. Requirements:

1. Provide power supplies approved by manufacturer of supplied electrified hardware.

2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
4. Provide power supplies with the following features:

    a. 12/24 VDC Output, field selectable.
    b. Class 2 Rated power limited output.
    c. Universal 120-240 VAC input.
    d. Low voltage DC, regulated and filtered.
    e. Polarized connector for distribution boards.
    f. Fused primary input.
    g. AC input and DC output monitoring circuit w/LED indicators.
    h. Cover mounted AC Input indication.
    i. Tested and certified to meet UL294.
    j. NEMA 1 enclosure.
    k. Hinged cover w/lock down screws.
    l. High voltage protective cover.

## 2.10 CYLINDERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

    a. Schlage Everest 29 T x 245 keyway to match existing

2. Acceptable Manufacturers and Products:

    a. No Substitute

B. Requirements:

1. Provide cylinders/cores compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset; manufacturer’s series as indicated. Refer to “KEYING” article, herein.
2. Provide cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.

    a. Conventional Patented Restricted: cylinder with interchangeable core with patented, restricted keyway.

3. Patent Protection: Cylinders/cores requiring use of restricted, patented keys, patent protected.
4. Nickel silver bottom pins.

## 2.11 KEYING

A. Scheduled System:

1. Existing factory registered system:

a. Provide cylinders/cores keyed into Owner's existing Schlage factory registered keying system. Comply with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Requirements:

1. Construction Keying:

a. Replaceable Construction Cores.
1) Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
a) 3 construction control keys
b) 12 construction change (day) keys.
2) Owner or Owner's Representative will replace temporary construction cores with permanent cores.

2. Permanent Keying:

a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
1) Master Keying system as directed by the Owner.

b. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
c. Provide keys with the following features:
1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
2) Patent Protection: Keys and blanks protected by one or more utility patent(s).

d. Identification:
1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
2) Identification stamping provisions must be approved by the Architect and Owner.
3) Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
5) Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.

e. Quantity: Furnish in the following quantities.
1) Change (Day) Keys: 3 per cylinder/core.
2) Permanent Control Keys: 3.
3) Master Keys: 6.

## 2.12 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. LCN 4040XP series

2. Acceptable Manufacturers and Products:

a. Corbin-Russwin DC8000 series
b. Sargent 281 series

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2 inch (38 mm) diameter piston with 5/8-inch (16 mm) diameter double heat-treated pinion journal. QR code with a direct link to maintenance instructions.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards. Provide snap-on cover clip, with plastic covers, that secures cover to spring tube.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck. Provide graphically labelled instructions on the closer body adjacent to each adjustment valve. Provide positive stop on reg valve that prevents reg screw from being backed out.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

## 2.13 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Trimco
b. Burns

B. Requirements:

1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

## 2.14 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Burns
b. Trimco

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Provide protection plates with countersunk screw holes.
3. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.
4. At fire rated doors, provide protection plates over 16 inches high with UL label.

## 2.15 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers:

a. Glynn-Johnson

2. Acceptable Manufacturers:

a. Rixson
b. ABH

B. Requirements:

1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.
2. Provide friction type at doors without closer and positive type at doors with closer.

## 2.16 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Trimco
b. Burns

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
2. Where a wall stop cannot be used, provide overhead stop.
3. Where wall or overhead stop cannot be used, provide floor stop.

4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

## 2.17 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer:

   a. Zero International

2. Acceptable Manufacturers:

   a. National Guard
   b. Reese

B. Requirements:

1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
4. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

## 2.18 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer:

   a. Ives

2. Acceptable Manufacturers:

   a. Steelcraft
   b. Republic

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

## 2.19 DOOR POSITION SWITCHES

A. Manufacturers:

1. Scheduled Manufacturer:

a. Schlage

2. Acceptable Manufacturers:

a. GE-Interlogix
b. Sentrol

B. Requirements:

1. Provide recessed or surface mounted type door position switches as specified.
2. Coordinate door and frame preparations with door and frame suppliers. If switches are being used with magnetic locking device, provide minimum of 4 inches (102 mm) between switch and magnetic locking device.

2.20 COAT HOOKS

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Burns
b. Trimco

B. Provide coat hooks as specified.

2.21 FINISHES

A. Finish: 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.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
4. Installation Guide for Doors and Hardware: DHI TDH-007-20

B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.

C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.

D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.

I. Lock Cylinders:

1. Install construction cores to secure building and areas during construction period.
2. Replace construction cores with permanent cores as indicated in keying section.
3. Furnish permanent cores to Owner for installation.

J. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:

1. Conduit, junction boxes and wire pulls.
2. Connections to and from power supplies to electrified hardware.
3. Connections to fire/smoke alarm system and smoke evacuation system.
4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
5. Connections to panel interface modules, controllers, and gateways.
6. Testing and labeling wires with Architect's opening number.

K. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.

L. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.

M. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

N. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

O. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

P. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

Q. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

## 3.03 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

## 3.04 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items per manufacturer’s instructions to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

## 3.05 DOOR HARDWARE SCHEDULE

A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier’s responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Discrepancies, conflicting hardware, and missing items are to 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.

C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.

D. Hardware Sets:

**HARDWARE GROUP NO. 01**

Provide each SGL door(s) with the following:

| QTY | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|
| 1 | EXISTING DOOR | EXISTING HARDWARE TO REMAIN. | | |

**HARDWARE GROUP NO. 02**

Provide each PR door(s) with the following:

| QTY | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|
| 1 | EXISTING DOOR | EXISTING HARDWARE TO REMAIN. | | |

**HARDWARE GROUP NO. 03**

Provide each RU door(s) with the following:

| QTY | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|
| | NOTE | HARDWARE BY DOOR SUPPLIER | | |

**HARDWARE GROUP NO. 04**

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | CLASSROOM SECURITY W/ INSIDE INDICATOR | L9071T 06A IS-LOC | 626 | SCH |
| 2 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 1 | EA | WALL STOP | WS406/407CVX | 630 | IVE |
| 3 | EA | SILENCER | SR64 | GRY | IVE |

**HARDWARE GROUP NO. 05**

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1HWSC 4.5 | 652 | IVE |
| 1 | EA | CLASSROOM LOCK | L9070T 06A | 626 | SCH |
| 1 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 1 | EA | OH STOP | 90S | 630 | GLY |
| 1 | EA | ARMOR PLATE | 8400 34" X 2" LDW B-CS | 630 | IVE |
| 3 | EA | SILENCER | SR64 | GRY | IVE |

**HARDWARE GROUP NO. 06**

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | STOREROOM LOCK | L9080T 06A | 626 | SCH |
| 1 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 1 | EA | WALL STOP | WS406/407CVX | 630 | IVE |
| 3 | EA | SILENCER | SR64 | GRY | IVE |

**HARDWARE GROUP NO. 07**

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 NRP | 652 | IVE |
| 1 | EA | STOREROOM LOCK | L9080T 06A | 626 | SCH |
| 1 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 1 | EA | WALL STOP | WS406/407CVX | 630 | IVE |
| 3 | EA | SILENCER | SR64 | GRY | IVE |

**HARDWARE GROUP NO. 08**

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 NRP | 652 | IVE |
| 1 | EA | STOREROOM LOCK | L9080T 06A | 626 | SCH |
| 1 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 1 | EA | OH STOP | 90S | 630 | GLY |
| 3 | EA | SILENCER | SR64 | GRY | IVE |

**HARDWARE GROUP NO. 09**

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | CLASSROOM SECURITY W/ INSIDE INDICATOR | L9071T 06A IS-LOC | 626 | SCH |
| 2 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 1 | EA | WALL STOP | WS406/407CVX | 630 | IVE |
| 3 | EA | SILENCER | SR64 | GRY | IVE |

**HARDWARE GROUP NO. 10**

Provide each PR door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 6 | EA | HINGE | 5BB1 4.5 X 4.5 NRP | 652 | IVE |
| 2 | EA | MANUAL FLUSH BOLT | FB457 12" | 626 | IVE |
| 1 | EA | DUST PROOF STRIKE | DP1 | 626 | IVE |
| 1 | EA | STOREROOM LOCK | L9080T 06A | 626 | SCH |
| 1 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 2 | EA | OH STOP | 90S | 630 | GLY |
| 2 | EA | KICK PLATE | 8400 10" X 1" LDW B-CS | 630 | IVE |
| 1 | EA | MEETING STILE | 383AA | AA | ZER |
| 2 | EA | SILENCER | SR64 | GRY | IVE |

**HARDWARE GROUP NO. 11**

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | PASSAGE SET | L9010 06A | 626 | SCH |
| 1 | EA | SURFACE CLOSER | 4011 | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | WALL STOP | WS406/407CVX | 630 | IVE |
| 1 | EA | GASKETING | 488SBK PSA | BK | ZER |

**HARDWARE GROUP NO. 12**

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 NRP | 630 | IVE |
| 1 | EA | CLASSROOM DEAD LOCK | L463T | 626 | SCH |
| 1 | EA | PRIVACY LOCK | L9040 06A 09-544 L283-722 | 626 | SCH |
| 1 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 1 | EA | SURFACE CLOSER | 4111 SCUSH | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | RAIN DRIP | 142AA | AA | ZER |
| 1 | SET | GASKETING | 429AA-S | AA | ZER |
| 1 | EA | DOOR SWEEP | 39A | A | ZER |
| 1 | EA | THRESHOLD | 655A-223 | A | ZER |
| 1 | EA | SINGLE HOOK | 507B | 626 | IVE |

**HARDWARE GROUP NO. 13**

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | CLASSROOM SECURITY W/ INSIDE INDICATOR | L9071T 06A IS-LOC | 626 | SCH |
| 2 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 1 | EA | SURFACE CLOSER | 4011 | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | WALL STOP | WS406/407CVX | 630 | IVE |
| 3 | EA | SILENCER | SR64 | GRY | IVE |

**HARDWARE GROUP NO. 14**

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | CLASSROOM SECURITY W/ INSIDE INDICATOR | L9071T 06A IS-LOC | 626 | SCH |
| 2 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 1 | EA | SURFACE CLOSER | 4111 CUSH | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | GASKETING | 488SBK PSA | BK | ZER |

**HARDWARE GROUP NO. 15**

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | CLASSROOM SECURITY W/ INSIDE INDICATOR | L9071T 06A IS-LOC | 626 | SCH |
| 2 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 1 | EA | SURFACE CLOSER | 4011 | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | WALL STOP | WS406/407CVX | 630 | IVE |
| 1 | EA | GASKETING | 488SBK PSA | BK | ZER |

**HARDWARE GROUP NO. 16**

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 NRP | 652 | IVE |
| 1 | EA | STOREROOM LOCK | L9080T 06A | 626 | SCH |
| 1 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 1 | EA | SURFACE CLOSER | 4111 CUSH | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | GASKETING | 488SBK PSA | BK | ZER |

**HARDWARE GROUP NO. 17**

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1HW 4.5 X 4.5 NRP | 630 | IVE |
| 1 | EA | STOREROOM LOCK | L9080T 06A | 626 | SCH |
| 1 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 1 | EA | LOCK GUARD | LG1 | 630 | IVE |
| 1 | EA | SURFACE CLOSER | 4111 SHCUSH | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | RAIN DRIP | 142AA | AA | ZER |
| 1 | SET | GASKETING | 429AA-S | AA | ZER |
| 1 | EA | DOOR SWEEP | 39A | A | ZER |
| 1 | EA | THRESHOLD | 655A-223 | A | ZER |

**HARDWARE GROUP NO. 18**

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | STOREROOM LOCK | L9080T 06A | 626 | SCH |
| 1 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 1 | EA | SURFACE CLOSER | 4011 | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | WALL STOP | WS406/407CVX | 630 | IVE |
| 1 | EA | GASKETING | 488SBK PSA | BK | ZER |

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. ACCESS BY KEY FROM OUTSIDE. INSIDE LEVER ALWAYS FREE FOR EGRESS.

**HARDWARE GROUP NO. 19**

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | CLASSROOM SECURITY W/ INSIDE INDICATOR | L9071T 06A IS-LOC | 626 | SCH |
| 2 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 1 | EA | OH STOP | 90S | 630 | GLY |
| 1 | EA | SURFACE CLOSER | 4011 | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | GASKETING | 488SBK PSA | BK | ZER |

**HARDWARE GROUP NO. 20**

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | CLASSROOM SECURITY W/ INSIDE INDICATOR | L9071T 06A IS-LOC | 626 | SCH |
| 2 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 1 | EA | SURFACE CLOSER | 4011 | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | WALL STOP | WS406/407CVX | 630 | IVE |
| 1 | EA | GASKETING | 488SBK PSA | BK | ZER |

**HARDWARE GROUP NO. 21**

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | FAC RESTRM /HOTEL W/IND | L9486T 06A L583-363 L583-375 | 626 | SCH |
| 1 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 1 | EA | SURFACE CLOSER | 4011 | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | WALL STOP | WS406/407CVX | 630 | IVE |
| 1 | EA | COAT AND HAT HOOK | 507 | 626 | IVE |
| 3 | EA | SILENCER | SR64 | GRY | IVE |

**HARDWARE GROUP NO. 22**

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | FAC RESTRM /HOTEL W/IND | L9486T 06A L583-363 L583-375 | 626 | SCH |
| 1 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 1 | EA | SURFACE CLOSER | 4011 | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | WALL STOP | WS406/407CVX | 630 | IVE |
| 1 | EA | GASKETING | 488SBK PSA | BK | ZER |
| 1 | EA | COAT AND HAT HOOK | 507 | 626 | IVE |

**HARDWARE GROUP NO. 23**

Provide each PR door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 6 | EA | HINGE | 5BB1 4.5 X 4.5 NRP | 652 | IVE |
| 1 | EA | CONST LATCHING BOLT | FB51P | 630 | IVE |
| 1 | EA | DUST PROOF STRIKE | DP1 | 626 | IVE |
| 1 | EA | STOREROOM LOCK | L9080T 06A | 626 | SCH |
| 1 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 1 | EA | COORDINATOR | COR X FL | US26D | IVE |
| 2 | EA | SURFACE CLOSER | 4111 CUSH | 689 | LCN |
| 2 | EA | KICK PLATE | 8400 10" X 1" LDW B-CS | 630 | IVE |
| 1 | EA | GASKETING | 488SBK PSA | BK | ZER |
| 1 | EA | MEETING STILE | 383AA | AA | ZER |

**HARDWARE GROUP NO. 24**

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 NRP | 652 | IVE |
| 1 | EA | FIRE EXIT HARDWARE | 99-L-F-06 | 626 | VON |
| 1 | EA | RIM CYLINDER | 20-057 ICX | 626 | SCH |
| 1 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 1 | EA | SURFACE CLOSER | 4111 EDA | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | WALL STOP | WS406/407CVX | 630 | IVE |
| 1 | EA | GASKETING | 488SBK PSA | BK | ZER |

**HARDWARE GROUP NO. 25**

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 NRP | 630 | IVE |
| 1 | EA | PANIC HARDWARE | CDSI-99-NL | 626 | VON |
| 1 | EA | RIM CYLINDER | 20-057 ICX | 626 | SCH |
| 1 | EA | MORTISE CYLINDER | 20-061 ICX 36-083 | 626 | SCH |
| 2 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 1 | EA | SURFACE CLOSER | 4111 SCUSH | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | RAIN DRIP | 142AA | AA | ZER |
| 1 | SET | GASKETING | 429AA-S | AA | ZER |
| 1 | EA | DOOR SWEEP | 39A | A | ZER |
| 1 | EA | THRESHOLD | 655A-223 | A | ZER |

**HARDWARE GROUP NO. 26**

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 NRP | 630 | IVE |
| 1 | EA | PANIC HARDWARE | LD-99-NL | 626 | VON |
| 1 | EA | RIM CYLINDER | 20-057 ICX | 626 | SCH |
| 1 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 1 | EA | SURFACE CLOSER | 4111 SHCUSH | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | RAIN DRIP | 142AA | AA | ZER |
| 1 | SET | GASKETING | 429AA-S | AA | ZER |
| 1 | EA | DOOR SWEEP | 39A | A | ZER |
| 1 | EA | THRESHOLD | 655A-223 | A | ZER |

**HARDWARE GROUP NO. 27**

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 1 | EA | CONT. HINGE | 224XY | 628 | IVE |
| 1 | EA | PANIC HARDWARE | LD-99-NL | 626 | VON |
| 1 | EA | RIM CYLINDER | 20-057 ICX | 626 | SCH |
| 1 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 1 | EA | SURFACE CLOSER | 4111 SHCUSH | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | RAIN DRIP | 142AA | AA | ZER |
| 1 | SET | GASKETING | 429AA-S | AA | ZER |
| 1 | EA | DOOR SWEEP | 39A | A | ZER |
| 1 | EA | THRESHOLD | 655A-223 | A | ZER |

**HARDWARE GROUP NO. 28**

Provide each PR door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 6 | EA | HINGE | 5BB1 4.5 X 4.5 NRP | 652 | IVE |
| 1 | EA | FIRE RATED REMOVABLE MULLION | KR9954 | 689 | VON |
| 1 | EA | FIRE EXIT HARDWARE | 99-EO-F | 626 | VON |
| 1 | EA | FIRE EXIT HARDWARE | 99-L-F-06 | 626 | VON |
| 1 | EA | RIM CYLINDER | 20-057 ICX | 626 | SCH |
| 1 | EA | MORTISE CYLINDER | 20-061 ICX 36-083 | 626 | SCH |
| 2 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 2 | EA | SURFACE CLOSER | 4111 CUSH | 689 | LCN |
| 2 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | GASKETING | 488SBK PSA | BK | ZER |
| 1 | EA | MULLION SEAL | 8780NBK PSA | BK | ZER |

**HARDWARE GROUP NO. 29**

Provide each PR door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 6 | EA | HINGE | 5BB1 4.5 X 4.5 NRP | 652 | IVE |
| 1 | EA | REMOVABLE MULLION | KR4954 STAB | 689 | VON |
| 1 | EA | PANIC HARDWARE | CDSI-99-DT | 626 | VON |
| 1 | EA | PANIC HARDWARE | CDSI-99-NL | 626 | VON |
| 1 | EA | RIM CYLINDER | 20-057 ICX | 626 | SCH |
| 3 | EA | MORTISE CYLINDER | 20-061 ICX 36-083 | 626 | SCH |
| 4 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 2 | EA | SURFACE CLOSER | 4111 SHCUSH | 689 | LCN |
| 2 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | GASKETING | 488SBK PSA | BK | ZER |
| 1 | EA | MULLION SEAL | 8780NBK PSA | BK | ZER |

**HARDWARE GROUP NO. 30**

Provide each PR door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 6 | EA | HINGE | 5BB1 4.5 X 4.5 NRP | 652 | IVE |
| 1 | EA | FIRE EXIT HARDWARE | 9927-EO-F-LBRAFL-499F | 626 | VON |
| 1 | EA | FIRE EXIT HARDWARE | 9927-L-F-LBRAFL-06-499F | 626 | VON |
| 1 | EA | RIM CYLINDER | 20-057 ICX | 626 | SCH |
| 1 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 2 | EA | SURFACE CLOSER | 4111 EDA | 689 | LCN |
| 2 | EA | KICK PLATE | 8400 10" X 1" LDW B-CS | 630 | IVE |
| 2 | EA | FIRE/LIFE WALL MAG | SEM7850 AS REQ (12/24/120V AC/DC TRI-VOLT) | 689 | LCN |
| 2 | SET | MEETING STILE | 328AA-S | AA | ZER |
| 1 | EA | GASKETING | 488SBK PSA | BK | ZER |

**HARDWARE GROUP NO. 31**

Provide each PR door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 6 | EA | HINGE | 5BB1 4.5 X 4.5 NRP | 652 | IVE |
| 2 | EA | FIRE EXIT HARDWARE | 9947-L-F-LBR-06 | 626 | VON |
| 2 | EA | RIM CYLINDER | 20-057 ICX | 626 | SCH |
| 2 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 2 | EA | SURFACE CLOSER | 4111 SCUSH | 689 | LCN |
| 2 | EA | KICK PLATE | 8400 10" X 1" LDW B-CS | 630 | IVE |
| 2 | SET | MEETING STILE | 328AA-S | AA | ZER |
| 1 | EA | GASKETING | 488SBK PSA | BK | ZER |

**HARDWARE GROUP NO. 32**

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | PUSH PLATE | 8200 6" X 16" | 630 | IVE |
| 1 | EA | PULL PLATE | 8303 10" 4" X 16" | 630 | IVE |
| 1 | EA | SURFACE CLOSER | 4011 | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | WALL STOP | WS406/407CVX | 630 | IVE |
| 3 | EA | SILENCER | SR64 | GRY | IVE |

Operational Description: Doors normally closed and unlocked. Push/pull operation.

**HARDWARE GROUP NO. 33**

Provide each SGL door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 3 | EA | HINGE | 5BB1 4.5 X 4.5 | 652 | IVE |
| 1 | EA | CLASSROOM DEAD LOCK | L463T | 626 | SCH |
| 1 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 1 | EA | PUSH PLATE | 8200 6" X 16" | 630 | IVE |
| 1 | EA | PULL PLATE | 8303 10" 4" X 16" | 630 | IVE |
| 1 | EA | SURFACE CLOSER | 4011 | 689 | LCN |
| 1 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | WALL STOP | WS406/407CVX | 630 | IVE |
| 3 | EA | SILENCER | SR64 | GRY | IVE |

**HARDWARE GROUP NO. 34**

Provide each PR door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 2 | EA | CONT. HINGE | 224XY | 628 | IVE |
| 1 | EA | REMOVABLE MULLION | KR4954 STAB | 689 | VON |
| 2 | EA | PANIC HARDWARE | CDSI-33A-EO | 626 | VON |
| 2 | EA | MORTISE CYLINDER | 20-061 ICX 36-083 | 626 | SCH |
| 2 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 2 | EA | 90 DEG OFFSET PULL | 8190EZHD 10" O | 630-316 | IVE |
| 2 | EA | OH STOP | 100S | 630 | GLY |
| 2 | EA | SURFACE CLOSER | 4111 EDA | 689 | LCN |
| 1 | EA | MULLION SEAL | 8780NBK PSA | BK | ZER |
| 1 | EA | THRESHOLD | 655A-223 | A | ZER |
| | | | SEALS BY DOOR SUPPLIER | | |

OPERATIONAL DESCRIPTION: DOOR NORMALLY CLOSED AND LOCKED. NO OUTSIDE ACCESS, UNLESS DEVICE IS DOGGED FROM THE INSIDE. WHEN DEVICE IS DOGGED, FREE PUSH PULL OPERATION. IMMEDIATE EGRESS ALWAYS ALLOWED.

**HARDWARE GROUP NO. 35**

Provide each PR door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 2 | EA | CONT. HINGE | 224XY EPT | 628 | IVE |
| 2 | EA | POWER TRANSFER | EPT10 | 689 | VON |
| 1 | EA | REMOVABLE MULLION | KR4954 STAB | 689 | VON |
| 1 | EA | ELEC PANIC HARDWARE | CDSI-RX-LC-33A-EO | 626 | VON |
| 1 | EA | ELEC PANIC HARDWARE | RX-LC-QEL-33A-T-360T-CON 24 VDC | 626 | VON |
| 1 | EA | RIM CYLINDER | 20-057 ICX | 626 | SCH |
| 3 | EA | MORTISE CYLINDER | 20-061 ICX 36-083 | 626 | SCH |
| 4 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 2 | EA | 90 DEG OFFSET PULL | 8190EZHD 10" O | 630-316 | IVE |
| 2 | EA | OH STOP | 100S | 630 | GLY |
| 2 | EA | SURFACE CLOSER | 4111 EDA | 689 | LCN |
| 1 | EA | MULLION SEAL | 8780NBK PSA | BK | ZER |
| 1 | EA | THRESHOLD | 655A-223 | A | ZER |
| 1 | EA | WIRE HARNESS | CON-6W | | SCH |
| 2 | EA | WIRE HARNESS | CON-XX-P LENGTH AS REQUIRED FOR USE WITH DOOR | | SCH |
| 2 | EA | DOOR CONTACT | 679-05HM | BLK | SCE |
| 1 | EA | POWER SUPPLY | PS902 BBK 900-2RS KL900 120/240 VAC | LGR | SCE |
| 1 | SET | WIRING DIAGRAMS | DOOR ELEVATION AND POINT-TO-POINT | | SCE |
| | | | CARD READER BY OTHERS | | |
| | | | SEALS BY DOOR SUPPLIER | | |

OPERATIONAL DESCRIPTION: DOORS NORMALLY CLOSED AND LOCKED. AUTHORIZED ACCESS BY KEY OR VALID CREDENTIAL, WHICH SHUNTS DOOR POSITION SWITCHES AND MOMENTARILY RETRACTS EXIT DEVICE LATCHBOLT. IMMEDIATE EGRESS ALWAYS ALLOWED. DEPRESSING INSIDE PUSH RAIL SHUNTS DOOR POSITION SWITCHES FOR REQUEST TO EXIT (REX). DEVICES CAN BE DOGGED BY USE OF CYLINDER TO ALLOW FREE ACCESS.

**HARDWARE GROUP NO. 36**

Provide each PR door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 2 | EA | CONT. HINGE | 224XY EPT | 628 | IVE |
| 2 | EA | POWER TRANSFER | EPT10 | 689 | VON |
| 1 | EA | REMOVABLE MULLION | KR4954 STAB | 689 | VON |
| 1 | EA | ELEC PANIC HARDWARE | RX-LC-QEL-33A-EO-CON 24 VDC | 626 | VON |
| 1 | EA | ELEC PANIC HARDWARE | RX-LC-QEL-33A-T-360T-CON 24 VDC | 626 | VON |
| 1 | EA | RIM CYLINDER | 20-057 ICX | 626 | SCH |
| 2 | EA | MORTISE CYLINDER | 20-061 ICX 36-083 | 626 | SCH |
| 3 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 2 | EA | 90 DEG OFFSET PULL | 8190EZHD 10" O | 630-316 | IVE |
| 2 | EA | OH STOP | 100S | 630 | GLY |
| 1 | EA | SURFACE CLOSER | 4111 EDA | 689 | LCN |
| 1 | EA | SURF. AUTO OPERATOR | 4642 WMS 120 VAC | 689 | LCN |
| 2 | EA | ACTUATOR, TOUCHLESS | 8310-813 | | LCN |
| 1 | EA | MULLION SEAL | 8780NBK PSA | BK | ZER |
| 1 | EA | THRESHOLD | 655A-223 | A | ZER |
| 1 | EA | WIRE HARNESS | CON-6W | | SCH |
| 2 | EA | WIRE HARNESS | CON-XX-P LENGTH AS REQUIRED FOR USE WITH DOOR | | SCH |
| 2 | EA | DOOR CONTACT | 679-05HM | BLK | SCE |
| 1 | EA | POWER SUPPLY | PS902 BBK 900-4RL KL900 120/240 VAC | LGR | SCE |
| 1 | SET | WIRING DIAGRAMS | DOOR ELEVATION AND POINT-TO-POINT | | SCE |
| | | | CARD READER BY OTHERS | | |
| | | | SEALS BY DOOR SUPPLIER | | |

OPERATIONAL DESCRIPTION:
IMMEDIATE EGRESS ALWAYS ALLOWED.
ESL SWITCH IN EXIT DEVICE RAIL TO RETRACT AND HOLD EXIT DEVICE LATCHBOLTS AND ENABLE EXTERIOR AUTOMATIC OPERATOR ACTUATOR.
DOOR CAN BE MANUALLY PULLED OPEN OR AUTOMATICALLY OPERATED BY EXTERIOR OR INTERIOR ACTUATOR, WHICH SIGNALS AUTOMATIC OPERATOR TO OPEN RHR DOOR.

SECURE OPERATION:
ESL SWITCH IN EXIT DEVICE RAIL TO RELEASE EXIT DEVICE LATCHBOLT AND DISABLE EXTERIOR ACTUATOR TO CONTROL ENTRY. ACCESS BY KEY ONLY.
IMMEDIATE EGRESS ALWAYS ALLOWED.
AUTOMATIC OPERATION BY INTERIOR ACTUATOR WHICH WILL RETRACT EXIT DEVICE LATCHBOLT MOMENTARILY THEN SIGNAL AUTOMATIC OPERATOR TO OPEN RHR DOOR.

**HARDWARE GROUP NO. 37**

Provide each PR door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 2 | EA | CONT. HINGE | 224XY | 628 | IVE |
| 2 | EA | PUSH/PULL BAR | 9190EZHD-10"-NS | US32D-316 | IVE |
| 2 | EA | OH STOP | 100S | 630 | GLY |
| 2 | EA | SURFACE CLOSER | 4111 EDA | 689 | LCN |
| | | | SEALS BY DOOR SUPPLIER | | |

**HARDWARE GROUP NO. 38**

Provide each PR door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 2 | EA | CONT. HINGE | 224XY | 628 | IVE |
| 2 | EA | PUSH/PULL BAR | 9190EZHD-10"-NS | US32D-316 | IVE |
| 1 | EA | OH STOP | 100S | 630 | GLY |
| 1 | EA | SURFACE CLOSER | 4111 EDA | 689 | LCN |
| 1 | EA | SURF. AUTO OPERATOR | 4642 WMS 120 VAC | 689 | LCN |
| 2 | EA | ACTUATOR, TOUCHLESS | 8310-813 | | LCN |
| 1 | SET | WIRING DIAGRAMS | DOOR ELEVATION AND POINT-TO-POINT | | SCE |
| | | | SEALS BY DOOR SUPPLIER | | |

OPERATIONAL DESCRIPTION: DOORS NORMALLY CLOSED AND UNLOCKED. PUSH/PULL OPERATION, EITHER MANUALLY, OR AUTOMATICALLY BY WALL-MOUNTED WAVE ACTUATOR (RHR LEAF).

**HARDWARE GROUP NO. 39**

Provide each PR door(s) with the following:

| QTY | | DESCRIPTION | CATALOG NUMBER | FINISH | MFR |
|---|---|---|---|---|---|
| 2 | EA | CONT. HINGE | 224XY EPT | 628 | IVE |
| 2 | EA | POWER TRANSFER | EPT10 | 689 | VON |
| 1 | EA | REMOVABLE MULLION | KR4954 STAB | 689 | VON |
| 1 | EA | ELEC PANIC HARDWARE | CDSI-RX-LC-33A-EO | 626 | VON |
| 1 | EA | ELEC PANIC HARDWARE | RX-LC-QEL-33A-T-360T-CON 24 VDC | 626 | VON |
| 1 | EA | RIM CYLINDER | 20-057 ICX | 626 | SCH |
| 3 | EA | MORTISE CYLINDER | 20-061 ICX 36-083 | 626 | SCH |
| 4 | EA | FSIC CORE | 23-030 EV29 T | 626 | SCH |
| 2 | EA | 90 DEG OFFSET PULL | 8190EZHD 10" O | 630-316 | IVE |
| 2 | EA | OH STOP | 100S | 630 | GLY |
| 2 | EA | SURFACE CLOSER | 4111 EDA | 689 | LCN |
| 2 | EA | KICK PLATE | 8400 10" X 2" LDW B-CS | 630 | IVE |
| 1 | EA | RAIN DRIP | 142AA | AA | ZER |
| 1 | EA | MULLION SEAL | 8780NBK PSA | BK | ZER |
| 2 | EA | DOOR SWEEP | 39A | A | ZER |
| 1 | EA | THRESHOLD | 655A-223 | A | ZER |
| 1 | EA | WIRE HARNESS | CON-6W | | SCH |
| 2 | EA | WIRE HARNESS | CON-XX-P LENGTH AS REQUIRED FOR USE WITH DOOR | | SCH |
| 2 | EA | DOOR CONTACT | 679-05HM | BLK | SCE |
| 1 | EA | POWER SUPPLY | PS902 BBK 900-2RS KL900 120/240 VAC | LGR | SCE |
| 1 | SET | WIRING DIAGRAMS | DOOR ELEVATION AND POINT-TO-POINT | | SCE |
| | | | CARD READER BY OTHERS | | |

OPERATIONAL DESCRIPTION: DOORS NORMALLY CLOSED AND LOCKED. AUTHORIZED ACCESS BY KEY OR VALID CREDENTIAL, WHICH SHUNTS DOOR POSITION SWITCHES AND MOMENTARILY RETRACTS EXIT DEVICE LATCHBOLT. IMMEDIATE EGRESS ALWAYS ALLOWED. DEPRESSING INSIDE PUSH RAIL SHUNTS DOOR POSITION SWITCHES FOR REQUEST TO EXIT (REX). DEVICES CAN BE DOGGED BY USE OF CYLINDER TO ALLOW FREE ACCESS.

END OF SECTION

# SECTION 08 80 00 - GLAZING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Windows.
   2. Doors.
   3. Glazed entrances.
   4. Interior borrowed lites.
   5. Storefront framing.

B. Related Sections include the following:
   1. Division 08 Section “Aluminum Framed Entrances and Storefronts”
   2. Division 08 Section “Glazed Aluminum Curtain Walls”
   3. Division 08 Section “Flush Wood Doors”
   4. Division 08 Section “Hollow Metal Doors and Frames”

### 1.3 DEFINITIONS

A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

D. Deterioration of Coated Glass: Defects developed from normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

E. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

### 1.4 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the

following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
   1. Wind Loads: Provide glass, aluminum entrance, and storefront assemblies for wind loading of 146 mph basic wind speed (ASCE 7-98) and capable of withstanding minimum wind pressures of 40 psf inward and 40 psf outward acting normal to the plane of the wall and 50 psf acting at the corners.
      a. Other structural data: See sheet **G0-01, G0-02, & G0-03,** Structural Design, and Structural Drawings.
   2. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch, whichever is less.
      a. For insulating glass.
   3. Minimum Glass Thickness for Exterior or Interior Lites: Not less than 1/4" inch.
   4. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
   1. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
   2. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
      a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F.
      b. Solar Heat Gain Coefficient: NFRC 200.
      c. Solar Optical Properties: NFRC 300.

## 1.5 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: For the following products, in the form of 12-inch- square Samples for glass and of 12-inch-long Samples for sealants. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

C. Samples: For the following products, in the form of 12-inch- square Samples for glass.
   1. Coated vision glass.
   2. Insulating glass for each designation indicated.
   3. For each color (except black) of exposed glazing sealant indicated.

D. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

E. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
   1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.

F. Qualification Data: For installers.

G. Product Test Reports: For each of the following types of glazing products:
   1. Insulating glass.
   2. Glazing sealants.
   3. Glazing gaskets.

H. Warranties: Special warranties specified in this Section.

## 1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs qualified glass installers for this Project.

B. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type: **clear float glass, coated float glass, and insulating glass**.

C. Source Limitations for Glass Sputter-Coated with Solar-Control Low-E Coatings: Where solar-control low-e coatings of a primary glass manufacturer that has established a certified fabricator program is specified, obtain sputter-coated solar-control low-e-coated glass in fabricated units from a manufacturer that is certified by coated-glass manufacturer.

D. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.
   1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

E. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.
   1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
   2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

F. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 and, for wired glass, ANSI Z97.1.
   1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency or manufacturer acceptable to authorities having jurisdiction.
   2. Where glazing units, including Kind FT glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

G. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

H. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:
1. Insulating Glass Certification Council.

## 1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

## 1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

## 1.9 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below. Manufacturing defects are defined as failure or hermetic seal of air space (beyond that due to glass breakage) as evidenced by intrusion of dirt or moisture, internal condensation or fogging, deterioration of protected internal glass coatings, if any, and other visual indications of seal failure or performance; provided the manufacturer's instructions for handling, installing, protecting and maintaining units have been complied with during the warranty period. Warranty shall be non-prorated.
1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below. Manufacturing defects are defined as failure or hermetic seal of air space (beyond that due to glass breakage) as evidenced by intrusion of dirt or moisture, internal condensation or fogging, deterioration of protected internal glass coatings, if any, and other visual indications of seal failure or performance; provided the manufacturer's instructions for handling, installing, protecting and maintaining units have been complied with during the warranty period. Warranty shall be non-prorated.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 GLASS PRODUCTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include; but are not limited to, the following:
   1. AFG Industries, Inc.
   2. LOF Glass, Inc.
   3. PPG Industries, Inc.
   4. Old Castle Glass, Inc.
   5. Guardian Sun Guard

B. Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality-Q3; of class indicated.

C. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
   2. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
   3. For uncoated glass, comply with requirements for Condition A.
   4. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
   5. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.

D. Sputter-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide or -nitride coating deposited by vacuum deposition process after manufacture and heat treatment (if any), and complying with other requirements specified.

E. Translucent Glazing: Provide where indicated.

F. Wired Glass: ASTM C 1036, Type II (patterned and wired flat glass), Class 1 (clear), Quality-Q-6; and of form and mesh pattern specified.
   1. Polished Wire Glass: Form 1 (wired, polished both sides), Mesh M2 (square).

G. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.
   1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
   2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated.

3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
   a. Performance Classification per ASTM E 774: Class A.
   b. Thickness of Each Pane: 1/4".
   c. Air Space Thickness: 1/2".
   d. Sealing System: Dual seal, primary and secondary sealant: manufacturer's standard.
   e. Spacer Material: Manufacturer's standard metal.
   f. Dessicant: Manufacturer's standard; either molecular sieve or silica gel or blend of both.
   g. Corner Construction: Manufacturer's standard corner construction.
4. Sealing System: Dual seal, with primary and secondary sealants as follows:
   a. Manufacturer's standard sealants.
5. Spacer Specifications: Manufacturer's standard spacer material and construction.

## 2.3 INSULATING-GLASS UNITS

A. Solar Control Tinted Low-E Insulating-Glass Units: Manufacturer's standard units complying with the following requirements (use tempered or heat strengthened where shown on the drawings and required by the manufacturer and the NC Building Code):
   1. Insulating Glass: Vitro Architectural Glass 1” Solarban 70 (2) Tinted Insulating Glass Unit or approved equal.
   2. Exterior Pane: Tinted heat strengthened glass.
   3. Interior Pane: Clear heat strengthened glass with Low-E high performance sputter coat on #2 surface.
   4. Overall Unit Thickness & Thickness Each Lite: 1/4” glass panes and ½” air space. Overall thickness 1”.
   5. Interspace Content: Air.
   6. Tint Color: Selected from Manufacturers standard glass tint. Basis of Design is Vitro Tint Color “Optigray”
   7. Kind: HS (heat strengthened).
   8. Visible Transmittance: 46%
   9. Summer U Value: 0.26
   10. Winter U Value: 0.28
   11. Shading Coefficient: 0.26
   12. Solar Heat Gain: 0.23
   13. Outdoor Visible Reflectance: 9%

## 2.4 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
   1. Neoprene, ASTM C 864.
   2. EPDM, ASTM C 864.
   3. Silicone, ASTM C 1115.
   4. Thermoplastic polyolefin rubber, ASTM C 1115.
   5. Any material indicated above.

## 2.5 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will 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.

B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

## 2.6 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; 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; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
1. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

## 2.7 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

## 2.8 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:
1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.

2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

## 3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. 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.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:
1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
    a. 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.

H. 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.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

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 and then to jambs. Cover horizontal framing joints by applying tapes to jambs and 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 just before each glazing unit is installed.

F. 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.

G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. 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 by gasket manufacturer.

D. 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. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

**END OF SECTION 08 80 00**

# SECTION 08 90 00 - LOUVERS AND VENTS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:
   1. Fixed, extruded-aluminum louvers.

### 1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.
C. Vertical Louver: Louver with vertical blades; i.e., the axes 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. Storm-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

### 1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer currently licensed in the State of North Carolina, using performance requirements and design criteria indicated. The submittals shall be signed and sealed by the qualified professional engineer currently licensed in the State of North Carolina.
B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
   1. Wind Loads: Determine loads based on a uniform pressure of 40 lbf/sq. ft., acting inward or outward.
C. Air-Performance, Water-Penetration, and Air-Leakage Ratings: Provide louvers complying with performance requirements indicated as demonstrated by testing manufacturer's stock units of height and width indicated. Test units according to AMCA 500.

### 1.5 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing. The submittals shall be signed and sealed by the qualified professional engineer currently licensed in the State of North Carolina.
   1. Show mullion profiles and locations.
C. Samples for Initial Selection: For units with factory-applied color finishes.

## 1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
B. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

## 1.7 PROJECT CONDITIONS

A. Field Measurements: Check actual louver openings by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Where field measurements cannot be made without delaying the Work, guarantee opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions.

# PART 2 - PRODUCTS

## 2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.
B. Fasteners: Use types and sizes to suit unit installation conditions.
   1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.

   For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
C. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

## 2.2 FABRICATION, GENERAL

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
   1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern unless horizontal mullions are indicated.
C. Maintain equal louver blade spacing to produce uniform appearance.
D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
   1. Frame Type: Channel unless otherwise indicated.

2. Provide end dams for all louvers.

E. Include supports, anchorages, and accessories required for complete assembly.

F. Provide subsills made of same material as louvers extended sills for recessed louvers.

G. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

## 2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal Drainable Fixed Blade Storm-Resistant Louver:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Air Balance Inc.; a Mestek company.
   b. Air Flow Company, Inc.
   c. Airolite Company, LLC (The).
   d. All-Lite Architectural Products.
   e. American Warming and Ventilating, Inc.; a Mestek company.
   f. Arrow United Industries; a division of Mestek, Inc.
   g. Construction Specialties, Inc.
   h. Greenheck Fan Corporation.
   i. Industrial Louvers, Inc.
   j. NCA Manufacturing, Inc.
   k. Nystrom Building Products.
   l. Reliable Products, Inc.
   m. Ruskin Company; Tomkins PLC.
   n. United Enertech Corp..
2. Louver Depth: 4 inches OR 6 inches. Refer to mechanical plans.
3. Louver spacing (center to center): 3”
4. Frame and Blade Nominal Thickness: Not less than 0.081 inch.
5. Louver Performance Ratings:
   a. Free Area: Not less than 54% or as noted on the drawings
   b. Air Performance: Not more than 0.20-inch wg static pressure drop at 1000-fpm free-area intake velocity.
   c. Wind-Driven Rain Performance: No penetration under wind loads indicated on drawings.
6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

## 2.4 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: 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 kind 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.
3. Type: Rewirable frames with a driven spline or insert.

D. Louver Screening for Aluminum Louvers:

1. Insect Screening Aluminum, 18-by-18 mesh, 0.009-inch wire.

2.5 BLANK-OFF PANELS (Where Noted on Plans)

A. Uninsulated, Blank-Off Panels: Metal sheet attached to back of louver.
   1. Aluminum sheet for aluminum louvers, not less than 0.050-inch nominal thickness.
   2. Panel Finish: Same finish applied to louvers.
   3. Attach blank-off panels with stainless steel sheet metal screws.

2.6 FINISHES, GENERAL

A. Aluminum Finishes
   1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weather tight connection.
C. Form closely fitted joints with exposed connections accurately located and secured.
D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
F. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weather tight louver joints are required. Comply with Division 07 Section "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.
B. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

D. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

**END OF SECTION 08 90 00**

# SECTION 09 01 60 91 – TERRAZZO FLOOR RESTORATION

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

A. Refinishing and Repair terrazzo floors.
B. Provide all labor, material, and equipment necessary to complete the following terrazzo repair work.
C. Preparation of all surfaces to receive patching compound.
D. Repairs to delaminated areas.
E. Repair of cracks (as per NTMA recommendations).
F. Placement of patching compounds/terrazzo matrix.
G. Finish and curing of terrazzo.

### 1.2 REFERENCE STANDARDS

A. NTMA – Terrazzo Specifications; The National Terrazzo and Mosaic Association, Inc.; current edition located at www.ntma.com.

### 1.3 SUBMITTALS

A. Product Data: Provide manufacturer technical data for sealer and cleaner and grout.
B. Cleaning products to be used and Terrazzo Maintenance Data/Protocols for facility managers.
    a. Submit letter clearly identifying the terrazzo system (Epoxy, Cement, etc.) and that the products are suitable/compatible.

### 1.4 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with not fewer than 5 years of documented experience.
    1. Installer shall be a contractor member of NTMA in good standing and shall perform all work in accordance with NTMA standards.
    2. Use only skilled journeyman who are familiar and experienced with the materials and methods specified shall be used for terrazzo restoration/refinishing.
    3. Crack Repair: Prepare a sample area for each type of crack repair required (Hairline cracks 1/64□ to 1/16" in size; Cracks and voids larger than 1/8 inch) Repair shall demonstrate methods and quality of workmanship of crack repair.
    4. Patching: Prepare on-floor, a sample of patching. Patch shall demonstrate methods and quality of workmanship of patch repair.

## PART 2: PRODUCTS

### 2.1 MATERIALS

A. Cleaner: Potable water, free of iron, all cleaners (optional) must be pH neutral.
B. Sealer: Liquid type to completely seal matrix surface; not detrimental to terrazzo components.
C. Grout: Color to match existing matrix.
D. Matrix: Pigmented epoxy to match sample submitted.
E. Aggregates: Aggregates to match architects approved sample.

2.2 EQUIPMENT

A. All work shall be executed with conventional terrazzo grinding equipment according to NTMA published trade practice.

PART 3: EXECUTION

3.1 GENERAL

A. Perform work in accordance with NTMA recommendations as posted on the NTMA website (www.ntma.com).

3.2 PREPARATION

A. Cover and protect all adjacent finished surfaces during restoration process.

3.3 CRACK REPAIR

A. Determination
   1. The owner and contractor shall walk the entire floor and identify cracks and agree on
   a. NA (No Action) RC (Repair Crack) or RT (Replace Terrazzo)
   b. Hairline cracks are classified as less than 1/32 (0.030)
   c. Replacement (RT) shall be from architectural break to architectural break.

B. RC – REPAIR CRACK
   1. Clean crack of loose material, dirt or sealer.
   2. Fill with resin/to match existing. Use aggregate in the crack if crack is wider than ¼ inch.

3.4 RT – Replace Terrazzo (if repair is not to architectural break or existing terrazzo divider strip, the joining edge shall be a saw tooth (jagged edge)

A. Remove areas to be replaced.
B. Clean
C. Repair concrete, fill cracks in concrete substrate as needed. Fill cracks in concrete with hardening epoxy Optional upgrade: Employ the use of a mesh (isolation membrane) to cover crack with liquid applied membrane (epoxy systems only).
D. Fill area with epoxy or cement /cement matrix and approved aggregate mixture/blend.

3.5 INITIAL GRINDING

A. Wet or dry grind with appropriate medium diamonds/stones

3.6 GROUTING

A. Cleanse floor with clean water and rinse. Wet grind with 50 or higher abrasive grit medium diamonds.
B. Remove excess water and machine or hand grout with cement or epoxy material to fill as needed.

3.7 CURING GROUT

A. Allow grout to cure a minimum of 12 hours. Maintain ambient air temperature between 70°F (21°C) and 80°F (27°C).

3.8 FINE (Final) GRINDING

A. Grind with 120 grit carborundum or 200 grit resin bond diamond until grout has been removed from the terrazzo surface.

3.9 CLEANING AND SEALING:

A. Rinse with clean water and allow too thoroughly dry.

B. Seal: Apply sealer per sealer manufacturer's written directions.
C. Remove protection and clean any adjacent surfaces effected by the refinishing process.

3.10 PROTECTION

A. General Contractor shall protect the finish floor from all site activity until Substantial Completion.

**END OF SECTION 09 01 60 91**

# SECTION 09 29 00 - GYPSUM BOARD

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:
   1. Interior gypsum board
   2. Cement board panels.
   3. Interior wall and ceiling framing.
   4. Reveal and Trim Moldings.

B. Related Sections include the following:
   1. Division 06 Section "Rough Carpentry" for wood framing and furring that supports gypsum board.
   2. Division 07 Section "Thermal Insulation" for insulation and vapor retarders installed in assemblies that incorporate gypsum board.
   3. Division 09 Section "Tiling" for cementitious backer units installed as substrates for ceramic tile.

### 1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

### 1.4 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. Fire-Test-Response Characteristics: Where fire-resistance-rated gypsum board assemblies are indicated, provide gypsum board assemblies that comply with the following requirements:
   1. Fire-Resistance Ratings: As indicated by GA File Numbers in GA-600 "Fire Resistance Design Manual" or design designations in UL "Fire Resistance Directory" or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.
   2. Gypsum board assemblies indicated are identical to assemblies tested for fire resistance according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
   3. Deflection and Firestop Track: Top runner provided in fire-resistance-rated assemblies indicated is labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

C. Above-Ceiling Observation: Architect will conduct an above-ceiling observation prior to installation of gypsum board ceilings and report any deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
   1. Notify Architect one week in advance of the date and the time when the Project, or part of the Project, will be ready for an above-ceiling observation.

1.5 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
B. Do not install interior products until installation areas are enclosed and conditioned.
C. Do not install panels that are wet, those that are moisture damaged, and those that are 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 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 STEEL FRAMING AND FURRING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
   1. Steel Framing and Furring:
      a. Clark Steel Framing, Inc.
      b. Consolidated Systems, Inc.
      c. Dale Industries, Inc.
      d. Dietrich Industries, Inc.
      e. Marino/Ware (formerly Marino Industries Corp.).
      f. National Gypsum Co.; Gold Bond Building Products Division.
      g. Unimast, Inc.
B. Steel Framing Components for Suspended and Furred Ceilings:
   1. General: Provide components complying with ASTM C 754 for conditions indicated.
   2. Wire Ties: ASTM A 641, Class 1 zinc coating, soft temper, 0.062 inch thick.
   3. Wire Hangers: ASTM A 641, Class 1 zinc coating, soft temper, 0.162-inch diameter.
   4. Channels: Cold-rolled steel, 0.0598-inch minimum thickness of base (uncoated) metal and 7/16-inch- wide flanges, and as follows:
      a. Carrying Channels: 1-1/2 inches deep, 475 lb/1000 feet, unless otherwise indicated.
      b. Furring Channels: 3/4 inch deep, 300 lb/1000 feet, unless otherwise indicated.
      c. Finish: ASTM A 653, G 60 hot-dip galvanized coating for framing for exterior soffits and where indicated.
   5. Steel Rigid Furring Channels: ASTM C 645, hat shaped, depth of 7/8 inch, and minimum thickness of base (uncoated) metal as follows:
      a. Thickness: 0.0179 inch, unless otherwise indicated.
      b. Protective Coating: ASTM A 653, G 40 hot-dip galvanized coating.
C. Steel Framing for Walls and Partitions:
   1. General: Provide steel framing members complying with the following requirements:

a. Protective Coating: ASTM A 653, G 40 hot-dip galvanized coating.

2. Steel Studs and Runners: ASTM C 645, with flange edges of studs bent back 90 degrees and doubled over to form 3/16-inch- wide minimum lip (return), and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth:
   a. Thickness: minimum 24 gauge.
   b. Depth: 3-5/8 inches, unless otherwise indicated. Provide 1-1/2", 2-1/2", 6", 8" and other sizes indicated on drawings.
3. Steel Rigid Furring Channels: ASTM C 645, hat shaped, depth and minimum thickness of base (uncoated) metal as follows:
   a. Thickness: 0.0179 inch, unless otherwise indicated.
   b. Depth: 7/8 inch.
4. Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.

## 2.3 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent. Provide gypsum board of types indicated in maximum lengths available that will minimize end-to-end butt joints in each area indicated to receive gypsum board application.
   1. Widths: Provide gypsum board in widths of 48 inches.
   2. 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:
   3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Gypsum Co.
      b. BPB America Inc.
      c. G-P Gypsum.
      d. Lafarge North America Inc.
      e. National Gypsum Company.
      f. PABCO Gypsum.
      g. Temple.
      h. USG Corporation.

B. Regular Type:
   1. Thickness: 5/8 inch.
   2. Long Edges: Tapered.

C. Type C:
   1. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
   2. Long Edges: Tapered

D. Type X:
   1. Thickness: 5/8 inch.
   2. Long Edges: Tapered.
   3. Core: 5/8” inch,
   4. Long Edges: Tapered

E. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.
   1. Core: 5/8 inch, Type X.
   2. Long Edges: Tapered.

## 2.4 CEMENT BOARD PANELS

A. Cementitious Backer Units: ANSI A118.9.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Custom Building Products; Wonderboard.
   b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
   c. USG Corporation; DUROCK Cement Board.
3. Thickness: As indicated on Drawings.

## 2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
   2. Shapes:
      a. Cornerbead on outside corners.
      b. L-Bead: L-shaped; exposed long flange receives joint compound. Use L-bead unless otherwise indicated. Provide at all locations where gypsum board abuts dissimilar materials.
      c. Expansion (control) joint.
B. Exterior Trim: ASTM C 1047.
   1. Material: Hot-dip galvanized steel sheet, plastic, or rolled zinc.
   2. Shapes:
      a. Cornerbead.

## 2.6 REVEAL MOLDING

A. Manufacturer: Fry Reglet Corporation or equal
B. Finish: Clear Anodized.
C. Reveal Molding
   1. Size: 5/8” x 1”
   2. Basis of Design: DRM-625-100 by Fry Reglet Corporation.

## 2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.
B. Joint Tape:
   1. Interior Gypsum Wallboard: Paper.
   2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
   3. Tile Backing Panels: As recommended by panel manufacturer.
C. Joint Compound for Interior Gypsum Wallboard (EXCEPT SHOWER ROOMS): For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
      a. Use setting-type compound for installing paper-faced metal trim accessories.
   3. Fill Coat: For second coat, use drying-type, all-purpose compound.
   4. Finish Coat: For third coat, use drying-type, all-purpose compound.
   5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.
D. Joint Compound for Shower Room Applications:
   1. Shower Room Ceilings: Use setting-type taping compound and setting-type, sandable topping compound.
E. Joint Compound for Cementitious Backer Units panels:

1. Cementitious Backer Units: As recommended by backer unit manufacturer.

## 2.8 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
   2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
C. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."
   1. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following requirements:
      a. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   2. Available Products: Subject to compliance with requirements, acoustical sealants that may be incorporated in the Work include, but are not limited to, the following:
      a. Acoustical Sealant for Exposed and Concealed Joints:
         1) PL Acoustical Sealant; ChemRex, Inc.; Contech Brands.
         2) AC-20 FTR Acoustical and Insulation Sealant; Pecora Corp.
         3) SHEETROCK Acoustical Sealant; United States Gypsum Co.
D. Thermal Insulation and Sound Attenuation Blankets: As specified in Division 07 Section "Thermal Insulation."
E. Vapor Retarder: As specified in Division 07 Section "Thermal Insulation."

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLING STEEL FRAMING GENERAL

A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.
B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with United States Gypsum Co.'s "Gypsum Construction Handbook."
C. Do not bridge building control and expansion joints with steel framing or furring members. Independently frame both sides of joints with framing or furring members as indicated.

## 3.3 INSTALLING STEEL FRAMING FOR SUSPENDED AND FURRED CEILINGS

A. Suspend ceiling hangers from building 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 structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
4. Secure flat, angle, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure as well as for type of hanger involved, and in a manner that will not cause them to deteriorate or otherwise fail.
5. Do not attach hangers to steel roof deck. Attach hangers to structural members.
6. Do not connect or suspend steel framing from ducts, pipes, or conduit.

B. Sway-brace suspended steel framing with hangers used for support.

C. Install suspended steel framing components in sizes and at spacings indicated, but not less than that required by the referenced steel framing installation standard.
1. Wire Hangers: 48 inches o.c.
2. Carrying Channels (Main Runners): 48 inches o.c.
3. Furring Channels (Furring Members): 16 inches o.c.

D. Installation Tolerances: Install steel framing components for suspended ceilings so that cross-furring or grid suspension members are level to within 1/8 inch in 12 feet as measured both lengthwise on each member and transversely between parallel members.

E. Wire-tie or clip furring members to main runners and to other structural supports as indicated.

## 3.4 INSTALLING STEEL FRAMING FOR WALLS AND PARTITIONS

A. Install runners (tracks) at floors, ceilings, and structural walls and columns where gypsum board stud assemblies abut other construction.
1. Where studs are installed directly against exterior walls, install asphalt felt strips or foam gaskets between studs and wall.

B. Installation Tolerances: Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8 inch from the plane formed by the faces of adjacent framing.

C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
1. Cut studs ½ inch short of full height to provide perimeter relief.
2. For STC-rated and fire-resistance-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid structural surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed, to support gypsum board closures needed to make partitions continuous from floor to underside of solid structure.

D. Install steel studs and furring in sizes and at spacings indicated.
1. Single-Layer Construction: Space studs 16 inches o.c., unless otherwise indicated.
2. Multilayer Construction: Space studs 16 inches o.c., unless otherwise indicated.

E. Install steel studs so flanges point in the same direction and leading edge or end of each gypsum board panel can be attached to open (unsupported) edges of stud flanges first.

F. For curved partitions, install steel framing as follows:
1. Cut top and bottom runners through leg and web at 2-inch intervals for arc length. In cutting lengths of runners, allow for uncut straight lengths of not less than 12 inches at ends of arcs.

2. Bend runners to uniform curve of radius indicated and locate straight lengths so they are tangent to arcs.
3. Support outside (cut) leg of runners by clinching a 1-inch- high-by-0.0209-inch- thick steel sheet strip to inside of cut legs using metal lock fasteners.
4. Attach runners to structural elements at floor and ceiling with fasteners located 2 inches from ends and spaced 24 inches o.c.

G. Frame door openings to comply with GA-219, and with applicable published recommendations of gypsum board manufacturer, unless otherwise indicated. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
1. Install double 20-gage studs at each jamb, unless otherwise indicated.
2. Install cripple studs at head adjacent to each jamb stud, with a minimum ½-inch clearance from jamb stud to allow for installation of control joint.

H. Frame openings other than door openings to comply with details indicated or, if none indicated, as required for door openings. Install framing below sills of openings to match framing required above door heads.

## 3.5 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.
B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
C. Install sound-attenuation blankets, where indicated, prior to installing gypsum panels unless blankets are readily installed after panels have been installed on one side.
D. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
E. Attach gypsum panels to framing provided at openings and cutouts.
F. 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.
G. 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.
H. Form control and expansion joints with space between edges of adjoining gypsum panels.
I. 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.

J. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. 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.
K. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
L. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's recommendations.
1. Space screws a maximum of 12 inches o.c. for vertical applications.

## 3.6 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Regular Type: As indicated on Drawings.
   2. Type X: Install in Shower Rooms.
   3. Type C: Where required for specific fire-resistance-rated assembly indicated.
   4. Moisture- and Mold-Resistant Type: Restrooms and other wet areas as indicated on Drawings.

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.
   3. On Z-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. 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. Wet gypsum panels on surfaces that will become compressed when panels are installed over a curve and where curve radius prevents using dry panels. Comply with gypsum board manufacturer's recommendations relative to curve radii, wetting methods, stacking panels after wetting, and other preparations that precede installing wetted gypsum panels.
   4. Apply gypsum panels horizontally with wrapped edges perpendicular to studs. On convex sides of partitions, begin installation at one end of curved surface and fasten gypsum panels to studs as they are wrapped around the curve. On concave side, start fastening panels to stud at center of curve and work outward to panel ends. Fasten panels to framing with screws spaced 12 inches o.c.
   5. Allow wetted gypsum panels to dry before applying joint treatment.

## 3.7 APPLYING CEMENTITIOUS BACKER PANELS

A. Cementitious Backer Units: ANSI A108.11, at locations indicated.

## 3.8 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Exterior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners.

## 3.9 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
   1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
   2. Level 4: Gypsum board surfaces, unless otherwise indicated
      a. Primer and its application to surfaces are specified in other Division 09 Sections.

E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

F. Cementitious Backer Units: Finish according to manufacturer's written instructions.

G. Use the following joint compound combination as applicable to the finish levels specified:
   1. Embedding and First Coat: Ready-mixed, drying-type, all-purpose or taping compound. Fill (Second) Coat: Ready-mixed, drying-type, all-purpose or topping compound. Finish (Third) Coat: Ready-mixed, drying-type, all-purpose or topping compound.

H. For Level 4 gypsum board finish, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration.
   1. Where Level 1 gypsum board finish is indicated, embed tape in joint compound.

I. Install Level 5 finish in Corridors.

## 3.10 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

**END OF SECTION 09 29 00**

# SECTION 09 30 00 - TILING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:
   1. Porcelain tile (wall and floor).
   2. Waterproof membrane for tile installations.
   3. Crack-suppression membrane for thin-set tile installations.
   4. Cementitious backer units installed as part of tile installations.

### 1.2 DEFINITIONS

A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.
B. Facial Dimension: Actual tile size (minor facial dimension as measured per ASTM C 499).
C. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

### 1.3 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Shop Drawings: Provide Tile shop drawing layout. Show the following:
   1. Columns, doorways, enclosing walls, or partitions, built-in casework.
   2. Existing flooring materials to be removed.
   3. Type of subfloor.
   4. Type of installation.
   5. Pattern of installation.
   6. Type, color, and location of insets and borders.
   7. Type, color, and location of edge, transition, and other accessory strips.
   8. Type, color, and location of edge, transition, and other accessory strips.
   9. Transition details to other flooring materials.
C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.
D. Samples for Verification:
   1. Full-size units of each type and composition of tile and for each color and finish required.
E. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
F. Product Certificates: For each type of product, signed by product manufacturer.
G. Qualification Data: For Installer.
H. Material Test Reports: For each tile-setting and -grouting product.

### 1.4 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain all tile of same type and color or finish from one source or producer.
   1. Obtain time tile 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 a single manufacturer and each aggregate from one source or producer.
C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:

1. Waterproofing.
2. Joint sealants.
3. Cementitious backer units.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.5 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 requirement in ANSI A137.1 for labeling sealed 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 avoided.
D. Store liquid latexes and emulsion adhesives in unopened containers and protected from freezing.
E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.6 PROJECT 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.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. 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.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

1. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
A. Provide tile complying with Standard grade requirements, unless otherwise indicated.
B. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.
2. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.
3. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
A. As selected by Architect from manufacturer's full range.
4. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, 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.
5. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.

2.2 TILE PRODUCTS

1. Approved Manufacturers:
   A. Daltile International
   B. American Olean
   C. American Marazzi Tile, Inc.
   D. Buchtal Corporation USA.
   E. Cerim-Floor Gres Ceramiche.
   F. Crossville Ceramics Company, L.P.
   G. Florida Tile Industries, Inc.
   H. GranitiFiandre.
   I. Interceramic.
   J. Quarry Tile Company.
   K. Seneca Tiles, Inc.
   L. United States Ceramic Tile Company.

2. Floor Tile: FT-1: ANSI A137.1
   A. Subject to compliance with requirements, Basis of Design: American Olean, Tile Line: Subtle Strands or equal from approved Manufacturers.
   B. Selection from Manufacturers full range of colors.
   C. Finish: Matte.
   D. Composition: Colorbody Porcelain.
   E. Module size: 3 inches by 3 inches mosaic (mesh mount)
   F. Nominal Thickness: 5/16 inch
   G. Grout for Tiling:
      a. Grout color: As selected by Architect from manufacturer's full range.
      b. Grout Joint Size: 1/8 inch.
   H. Tile Base: Only where there is no wall tile use 3x24 bullnose trim as the floor tile base.
   I. Metal Trim and Cove Protection: Refer to Accessories in spec.

3. Floor Tile: FT-2: ANSI A137.1
   A. Subject to compliance with requirements, Basis of Design: American Olean, Tile Line: Subtle Strands or equal from approved Manufacturers.
   B. Selection from Manufacturers full range of colors.
   C. Finish: Matte.
   D. Composition: Colorbody Porcelain.
   E. Module size: 12 inches by 24 inches
   F. Nominal Thickness: 5/16 inch
   G. Grout for Tiling:
      a. Grout color: As selected by Architect from manufacturer's full range.
      b. Grout Joint Size: 1/8 inch.
   H. Tile Base: Only where there is no wall tile use 3x24 bullnose trim as the floor tile base.
   I. Metal Trim and Cove Protection: Refer Accessories products in spec.

4. Floor Tile: FT-3: ANSI A137.1
   A. Subject to compliance with requirements, Basis of Design: Daltile, Tile Line: Continental Slate or equal from approved Manufacturers.
   B. Selection from Manufacturers full range of colors.
   C. Finish: Matte.
   D. Composition: Colorbody Porcelain.
   E. Module size: 6 inches by 6 inches
   F. Nominal Thickness: 5/16 inch
   G. Grout for Tiling:
      a. Grout color: As selected by Architect from manufacturer's full range.
      b. Grout Joint Size: 3/16 inch.

H. Metal Cove Protection: Refer Accessories products in spec.

5. Wall Tile: WT-1: ANSI A137.1
   A. Subject to compliance with requirements, Basis of Design: Daltile, Tile Line: Linden Point or equal from approved Manufacturers.
   B. Selection from Manufacturers full range of colors.
   C. Finish: Matte.
   D. Composition: Glazed Porcelain with Reveal Imaging.
   E. Module size: 12 inches by 24 inches
   F. Nominal Thickness: 3/8 inch
   G. Tile Trim for top of tile to Gypsum Wall Board: Bullnose 3x12
   H. Tile Trim for vertical tile edges: Bullnose 3x12
   I. Tile Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:
   J. Grout for Tiling:
      a. Grout color: As selected by Architect from manufacturer's full range.
      b. Grout Joint Size: 3/16 inch.

6. Wall Tile: WT-2: ANSI A137.1
   A. Subject to compliance with requirements, provide Daltile, Tile Line: Multitude (Flat) or equal from approved Manufacturers.
   B. Selection from Manufacturers full range of colors.
   C. Finish/Composition: Glazed Ceramic.
   D. Module size: 12 inches by 24 inches.
   E. Nominal Thickness: 5/16 inch
   **F. Face: Flat pattern.**
   G. Metal Trim for exposed vertical tile edges: Refer Accessories products in spec.
   H. Grout for Tiling:
      a. Grout color: As selected by Architect from manufacturer's full range.
      b. Grout Joint Size: 1/8 inch.

7. Wall Tile: WT-3: ANSI A137.1
   A. Subject to compliance with requirements, provide Daltile, Tile Line: Multitude (Wave) or equal from approved Manufacturers.
   B. Selection from Manufacturers full range of colors.
   C. Finish/Composition: Glazed Ceramic.
   D. Module size: 12 inches by 24 inches.
   E. Nominal Thickness: 5/16 inch
   **F. Face: Wave pattern.**
   G. Metal Trim for vertical tile edges: Refer Accessories products in spec.
   H. Grout for Tiling:
      a. Grout color: As selected by Architect from manufacturer's full range.
      b. Grout Joint Size: 1/8 inch.

8. Wall Tile: WT-4: ANSI A137.1
   A. Subject to compliance with requirements, Basis of Design: American Olean, Tile Line: Subtle Strands or equal from approved Manufacturers.
   B. Selection from Manufacturers full range of colors.
   C. Finish: Matte.
   D. Composition: Colorbody Porcelain.
   E. Module size: 12 inches by 24 inches
   F. Nominal Thickness: 5/16 inch
   G. Metal Trim for vertical tile edges: Refer Accessories products in spec.
   H. Metal Trim for outside corners: Refer Accessories products in spec.
   I. Grout for Tiling:

a. Grout color: As selected by Architect from manufacturer's full range.
b. Grout Joint Size: 1/8 inch.

9. Wall Tile: WT-5: ANSI A137.1
   A. Subject to compliance with requirements, provide Daltile, Tile Line: Multitude (Wave) or equal from approved Manufacturers.
   B. Selection from Manufacturers full range of colors.
   C. Finish/Composition: Glazed Ceramic.
   D. Module size: 12 inches by 24 inches.
   E. Nominal Thickness: 5/16 inch
   **F. Face: Wave pattern.**
   G. Grout for Tiling:
      a. Grout color: As selected by Architect from manufacturer's full range.
      b. Grout Joint Size: 1/8 inch.

## 2.3 ACCESSORY PRODUCTS

1. Metal Wall Trim: Basis of Design: QUADEC by Schluter
   A. Description: Profile with square visible surface, integrated trapezoid perforated anchoring leg, and integrated grout joint spacer.
   B. Corners:
      a. Provide with matching inside corners.
      b. Provide with matching outside corners
      c. Provide with matching end caps
      d. Provide with matching connectors
   C. Material: Stainless Steel TYPE 304
   D. Height: Suitable for thickness of specified tile.

2. Metal Base Trim for Cove Protection: Basis of Design: DILEX-EHK by Schluter
   A. Description: Roll-formed stainless-steel profile with integrated trapezoid perforated anchoring legs, connected at a 90-degree angle by a cove shaped section with 23/32” radius that forms the visible surface.
   B. Corners:
      a. Provide with matching inside corners.
      b. Provide with matching outside corners
      c. Provide with matching end caps
      d. Provide with matching connectors
   C. Material: Stainless Steel TYPE 304
   D. Height: Suitable for thickness of specified tile.
   E. Metal Cove Protection Base: To be used at all porcelain floor tile locations around perimeter of room.

## 2.4 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
   a. Bevel edges at 1:2 slope, aligning lower edge of bevel with adjacent floor. Limit height of bevel to ½ inch or less and finish bevel to match face of threshold.
B. Shower Stall: Basis of Design shall be Aluminum Shower Profile WS by Schluter.
C. Porcelain Tile to Vinyl tile flooring transition: Basis of Design shall be stainless steel Reno-U by Schluter.
D. Use Stainless Steel RENO-U by Schluter if ½” height or less and RENO Ramp if 9/16” height or more.
E. Unless otherwise noted refer to drawings.

F. For additional thresholds transition strips refer to specification Division 096513 Resilient Base and Accessories.

2.5 WATERPROOFING FOR THIN-SET TILE INSTALLATIONS

1. General: Manufacturer's standard product that complies with ANSI A118.10.
2. Fabric-Reinforced, Fluid-Applied Product: System consisting of liquid-latex rubber, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), and fabric reinforcement.
   A. Available Products:
      a. Custom Building Products; Trowel & Seal Waterproofing and Anti-FractureMembrane.
      b. LATICRETE International Inc.; Laticrete 9235 Waterproof Membrane.
      c. MAPEI Corporation; PRP M19.

2.6 SETTING AND GROUTING MATERIALS

1. Manufacturers:
   A. Atlas Minerals & Chemicals, Inc.
   B. Boiardi Products Corporation.
   C. Bonsal, W. R., Company.
   D. Bostik.
   E. C-Cure.
   F. Custom Building Products.
   G. DAP, Inc.
   H. Jamo Inc.
   I. LATICRETE International Inc.
   J. MAPEI Corporation.
   K. Southern Grouts & Mortars, Inc.
   L. TEC Specialty Products Inc.

2.7 LATEX-PORTLAND CEMENT MORTAR (THIN SET): ANSI A118.4, consisting of the following:

A. Prepackaged dry-mortar mix containing dry, redispersible, ethylene vinyl acetate additive to which only water must be added at Project site.
   1. For wall applications, provide nonsagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4.
B. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.
C. Standard Sanded Cement Grout: ANSI 118.7 Polymer Modified Cement Grouts, color as indicated.
D. Standard Unsanded Cement Grout: ANSI 118.7 Polymer Modified Cement Grouts, color as indicated.
   1. Polymer Type: Either ethylene vinyl acetate, in dry, redispersible form, prepackaged with other dry ingredients, or acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.
      a. Unsanded grout mixture for joints 3/16 inch and narrower.
      b. Sanded grout mixture for joints 1/8 inch and wider.

2.8 PORTLAND CEMENT MORTAR (THICK SET): ANSI A108.1A and as specified below:

A. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils thick.

B. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A 185 and ASTM A 82 except for minimum wire size.
C. Expanded Metal Lath: Diamond-mesh lath complying with ASTM C 847.
1. Base Metal and Finish for Interior Applications: Uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.
2. Configuration over Solid Surfaces: Self-furring.
3. Weight: 2.5 lb/sq. yd.
4. Latex Additive: acrylic resin water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.

## 2.9 ELASTOMERIC SEALANTS

1. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 07 Section "Joint Sealants."
   A. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.
3. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in- service exposures of high humidity and extreme temperatures.
   A. Available Products:
      1. Dow Corning Corporation; Dow Corning 786.
      2. GE Silicones; Sanitary 1700.
      3. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
      4. Tremco, Inc.; Tremsil 600 White.
4. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
   A. Available Products:
      1. Bostik; Chem-Calk 550.
      2. Mameco International, Inc.; Vulkem 245.
      3. Pecora Corporation; NR-200 Urexpan.
      4. Tremco, Inc.; THC-900.

## 2.10 CEMENTITIOUS BACKER UNITS

1. Provide cementitious backer units complying with ANSI A118.9 in maximum lengths available to minimize end-to-end butt joints.
   A. Thickness: 1/2 inch
   B. Width: 48 inches
2. Available Products:
   A. C-Cure; C-Cure Board 990.
   B. Custom Building Products; Wonderboard.
   C. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
   D. USG Corporation; DUROCK Cement Board.

## 2.11 MISCELLANEOUS MATERIALS

1. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
2. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications, white

zinc alloy exposed-edge material.

3. 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.
4. Grout Sealer: Manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.
   A. Available Products:
      1. Bonsal, W. R., Company; Grout Sealer.
      2. Bostik; CeramaSeal Grout Sealer.
      3. C-Cure; Penetrating Sealer 978.
      4. Custom Building Products; Surfaceguard Grout and Tile Grout Sealer.
      5. Jamo Inc.; Matte FinishPenetrating Sealer.
      6. MAPEI Corporation; KER 003, Silicone Spray Sealer for Cementitious Tile Grout 004, Keraseal Penetrating Sealer for Unglazed Grout and Tile.
      7. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.
      8. TEC Specialty Products Inc.; TA-256 Penetrating Silicone TA-257 Silicone Grout Sealer.

2.12 MIXING MORTARS AND GROUT

1. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
2. Add materials, water, and additives in accurate proportions.
3. 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 installed tile.
   1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
   2. 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 before installing tile.
   3. 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. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.
B. Provide concrete substrates for tile floors installed with thin-set mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
   1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
   2. Remove protrusions, bumps, and ridges by sanding or grinding.
C. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, 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.

## 3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCNA Installation Guidelines: TCNA's "Handbook for Ceramic Tile Installation." Comply with TCNA installation methods indicated in ceramic tile installation schedules.

C. 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.

D. 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.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. 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.

F. Lay out tile wainscots to next full tile beyond dimensions indicated.

G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
   1. Locate joints in tile surfaces directly above joints in concrete substrates.
   2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

H. Grout tile to comply with requirements of the following tile installation standards:
   1. For ceramic tile grouts (sand-portland cement; dry-set, commercial portland cement; and latex- portland cement grouts), comply with ANSI A108.10.
   2. For 100% solids chemical-resistant epoxy grouts, comply with ANSI A108.6.
   3. For chemical-resistant furan grouts, comply with ANSI A108.8.

I. At showers, tubs, and where indicated, install cementitious backer units and treat joints to comply with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

## 3.4 FLOOR TILE INSTALLATION

A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCNA installation methods (latest edition) and ANSI A108 Series of tile installation standards.
   1. For installations indicated below, follow procedures in ANSI A108 Series tile installation standards for providing 95 percent mortar coverage.
      a. Tile floors in wet areas.

B. Refer to **TCNA Installation Standard F122 for floor tile installation** for Thin Set Installations as indicated on the drawings.

C. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

D. Grout Sealer: Apply grout sealer to grout joints according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer that has gotten on tile faces by wiping with soft cloth.

3.5 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCNA installation methods (latest edition) and ANSI setting-bed standards.
B. Refer to **TCNA Installation Standard W244C for wall tile installation**. Water proof membrane shall be provided in the wall tile installation for the shower as reference in the noted TCNAstandard.
C. Install metal lath and scratch coat for walls to comply with ANSI A108.1A, Section 4.1.

3.6 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

**END OF SECTION 09 30 0**

# SECTION 095113 - ACOUSTICAL PANEL CEILINGS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes acoustical panels and exposed suspension systems for ceilings.
B. Related Sections include the following:
   1. Division 09 Section "Acoustical Tile Ceilings" for ceilings consisting of mineral-base acoustical tiles used with concealed suspension systems, stapling, or adhesive bonding.

### 1.3 DEFINITIONS

A. LR: Light Reflectance coefficient.
B. NRC: Noise Reduction Coefficient.

### 1.4 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Coordination Drawings: Reflected ceiling 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. Ceiling suspension system members.
   2. Method of attaching hangers to building structure.
   3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
C. Samples for Initial Selection: For components with factory-applied color finishes.
D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
   1. Acoustical Panel: Set of **6-inch- (150-mm-)** square samples of each type, color, pattern, and texture.
   2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- (300-mm-) long Samples of each type, finish, and color.
E. Research/Evaluation Reports: For each acoustical panel ceiling and components and anchor and fastener type.
F. Maintenance Data: For finishes to include in maintenance manuals.

### 1.5 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
B. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
2. Suspension System: Obtain each type through one source from a single manufacturer.

C. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.

D. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
a. Flame spread of 25 or less.
b. Smoke developed of 50 or less.

E. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:
1. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

## 1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

## 1.8 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

## 1.9 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. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.

## PART 2 - PRODUCTS

### 2.1 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
   1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
   1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

### 2.2 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING – ACP

A. Available Products: Subject to compliance with requirements, 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 CertainTeed, Inc., Ecophon Baffle, Rectangle, or a comparable product by one of the following:
   1. Armstrong World Industries, Inc.
   2. BPB USA
   3. Chicago Metallic Corporation
   4. Tectum Inc.
   5. USG Interiors, Inc.
   6. Wenger Corporation
   7. Decoustics
   8. Novawall Systems Inc.
   9. RPG Inc.
   10. Sound Seal

C. Classification: Provide fire-resistance-rated panels complying with ASTM E 1264 for type, form, and pattern as follows:
   1. Type and Form: Type XII, glass-fiber base with membrane-faced overlay; Form 2.
   2. Pattern: G (smooth)

D. Color: A**s** selected from manufacturer's full range.

E. LR: Up to 0.85.

F. Performance Criteria
   1. Average Sabins per unit with rows spaced 2-ft O.C. (per ASTM C423 at NRC frequencies): 14.7

G. Edge/Joint Detail: Square

H. Thickness: **1-1/2 inches**

I. Modular Size: **22 by 94 inches**

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
   2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 12 gauge diameter wire.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
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 to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   3. Splay hangers only where required and to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   4. 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.
   5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
   6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both

structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
8. 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.
9. Do not attach hangers to steel deck tabs.
10. Do not attach hangers to steel roof deck. Attach hangers to structural members.
11. 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.
12. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install 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 with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:
   a. As indicated on reflected ceiling plans.

## 3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

**END OF SECTION 095113**

# SECTION 09 51 23 - ACOUSTICAL TILE CEILINGS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes acoustical tiles for ceilings and the following:
   1. 2'x2' Acoustical Tile Lay-in Ceiling
   2. Suspended ceiling grid
B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

### 1.3 DEFINITIONS

A. AC: Articulation Class.
B. CAC: Ceiling Attenuation Class.
C. LR: Light-Reflectance coefficient.
D. NRC: Noise Reduction Coefficient.

### 1.4 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Coordination Drawings: Reflected ceiling 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. Ceiling suspension system members.
   2. Method of attaching hangers to building structure.
C. Samples for Initial Selection: For components with factory-applied color finishes.
D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical tile ceiling.
E. Maintenance Data: For finishes to include in maintenance manuals.
F. Certificates: Submit certificates from manufacturers of acoustical ceiling units and suspension systems attesting that their products comply with specification requirements.

### 1.5 QUALITY ASSURANCE

A. Source Limitations:
   1. Acoustical Ceiling Tile: Obtain each type through one source from a single manufacturer.
   2. Suspension System: Obtain each type through one source from a single manufacturer.
B. Fire-Test-Response Characteristics: Provide acoustical tile ceilings that comply with the following requirements:
   1. Surface-Burning Characteristics: Provide acoustical tiles with the following surface-burning characteristics complying with ASTM E 1264 for Class **A** materials as determined by testing identical products per ASTM E 84:

a. Smoke-Developed Index: 450 or less.

C. Seismic Standard: Provide acoustical tile ceilings designed and installed to withstand the effects of earthquake motions according to the following:

a. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical tiles, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

## 1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical tile ceiling installation.

## 1.8 COORDINATION

A. Coordinate layout and installation of acoustical tiles and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

## 1.9 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. Acoustical Ceiling Units: Full-size tiles equal to 2.0 percent of quantity installed.
2. Suspension System Components: Quantity of each concealed grid and exposed component equal to 2.0 percent of quantity installed.

# PART 2 - PRODUCTS

## 2.1 ACOUSTICAL TILES, GENERAL

A. Recycled Content: Provide acoustical tiles with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 20 percent by weight.

B. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

C. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.
   1. Where appearance characteristics of acoustical tiles are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

D. Sound Attenuation Performance: Provide acoustical ceiling units with ratings for ceiling sound transmission class (STC) of range indicated as determined according to AMA 1-II "Ceiling Sound Transmission Test by Two-Room Method" with ceilings continuous at partitions and supported by a metal suspension system of type appropriate for ceiling unit of configuration indicated (concealed for tile, exposed for panels).

E. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

## 2.2 ACOUSTICAL TILES FOR ACOUSTICAL TILE CEILING

A. Basis-of-Design Product (as listed below). Refer to drawings for locations of ceiling finish: Subject to compliance with requirements, provide Armstrong product as specified or a comparable product by one of the following:
   1. CertainTeed
   2. USG Interiors, Inc
   3. Armstrong World Industries, Inc.

B. Lay-in Ceiling Type A, “ACT-1” USG Olympia or equal by Armstrong or CertainTeed.
   1. Color: White.
   2. LR: Not less than 0.86.
   3. NRC: Not less than 0.60.
   4. CAC: Not less than 35.
   5. Edge/Joint Detail: Beveled Tegular.
   6. Thickness: min. 3/4 inch.
   7. Modular Size: 24 by 24 inches.
   8. Antimicrobial Treatment: Broad spectrum fungicide and bactericide based.
   9. 15 Year No-Sag Resistance: Provide 15 year no-sag warranty.

C. Lay-in Ceiling Type B, “ACT-2” Armstrong 2988 Pebble Fine Texture, USG 7050G Premier Hi-Lite Twill or equal by CertainTeed.
   1. Color: White.
   2. LR: Not less than 0.76.
   3. NRC: Not less than 0.70.
   4. CAC: N/A.
   5. Edge/Joint Detail: Square.
   6. Thickness: min. 5/8” inch.
   7. Modular Size: 24 by 24 inches.
   8. Surface Finish: Scrubbable Vinyl Film Facing
   9. Humidity tolerant: Humiguard Plus
   10. Antimicrobial Treatment: Broad spectrum fungicide and bactericide based.
   11. 15 Year No-Sag Resistance: Provide 15 year no-sag warranty.
   12. Metal Suspension System: Manufacturer’s standard. Color – White

D. Extruded Aluminum Trim Channel Armstrong Axiom Classic Edge Trim, USG or equal by CertainTeed.
   1. Color: White.
   2. Trim: Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
      a. Trim size: 6 inches tall

b. Commercial quality extruded aluminum alloy 6063 Trim Channel and Bottom Drywall Trim
c. Factory-applied baked polyester paint finish
d. Commercial quality aluminum T-Bar Connection Clip and Hanging Clip.
e. Galvanized steel Splice Plate.
f. Cross Tee/Main Beam Interface – Flush Fit
g. End Detail – Splice with screws
h. Trim Channel: 6” wide face with 3/4 inch horizontal legs, straight or curved sections with special bosses formed for attachment to the tee-bar connection clip or hanging clip
i. Outside Corner Posts (Straight Only): Commercial quality extruded aluminum sections formed to match the Axiom trim channel profile; pre-assembled with built-in splice plates that connect to straight sections; 7/8 inch x 7/8 inch x 6”
j. Inside Corners (Straight Only): Commercial quality extruded aluminum sections formed to match the Axiom trim channel profile that connect to straight sections, 12 inch x 3/4 inch x 6”
k. Hanging clip, commercial quality aluminum, unfinished, used when suspension wires must be attached directly to the trim sections.
l. Splice with set screws, galvanized steel, unfinished, used to attached factory-mitered inside corners

## 2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
B. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
C. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   1. Galvanized, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
   2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung" ) will be less than yield stress of wire, but provide not less than 12 gauge diameter wire.
E. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
F. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.
G. Seismic Struts: Manufacturer's standard compression struts designed to accommodate lateral forces.
H. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical tiles in-place.

## 2.4 METAL SUSPENSION SYSTEM FOR ACOUSTICAL TILE CEILING

A. Basis of Design: Prelude XL, 15/16” Profile. For ACT-1, ACT-2.
B. Products: Subject to compliance with requirements, provide one of the following:
   1. Armstrong World Industries, Inc.
   2. USG Interiors, Inc.
   3. Chicago Metalic
   4. CertainTeed
C. Intermediate Duty, Direct-Hung, Double-Web, Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G30 coating designation.

1. Structural Classification: Intermediate-duty system.
2. Access: Upward and end or side pivoted, with initial access openings of size indicated below and located throughout ceiling within each module formed by main and cross runners, with additional access available by progressively removing remaining acoustical tiles.

D. Indirect-Hung, Fire-Rated Suspension System: Main and cross runners roll formed from cold-rolled steel sheet with 15/16" wide exposed faces on structural members, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G30 coating designation.
1. Structural Classification: Intermediate-duty system.
2. Carrying Channels: Cold-rolled steel, 0.059850-inch- minimum base (uncoated) metal thickness, not less than 3/16-inch- wide flanges by 1-1/2-inch- deep steel channels, 475 lb/1000 feet, with rust-inhibitive paint finish.
3. Access: Where access is indicated, provide special cross runners or split splines to allow for removal of acoustical units in indicated access areas. Identify access tile with manufacturer's standard unobtrusive markers for each access unit.

## 2.5 METAL EDGE MOLDINGS AND TRIM

A. Products: Subject to compliance with requirements, provide one of the following:
1. Armstrong World Industries, Inc.
2. Chicago Metallic Corporation
3. USG Interiors, Inc.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
1. Provide manufacturer's standard edge moldings that fit acoustical tile edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

## 2.6 ACOUSTICAL SEALANT

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Products: Subject to compliance with requirements, provide one of the following:
1. Acoustical Sealant for Exposed and Concealed Joints:
   a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
   b. USG Corporation; SHEETROCK Acoustical Sealant.
2. Acoustical Sealant for Concealed Joints:
   a. OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sound Sealant.
   b. Pecora Corporation; BA-98.
   c. Tremco, Inc.; Tremco Acoustical Sealant.

C. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

D. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), recommended for sealing interior concealed joints to reduce airborne sound transmission.

2.7 MISCELLANEOUS MATERIALS

A. Hold-Down Clips for Non-Fire-Rated Ceilings: For interior ceilings composed of lay-in panels weighting less than 1 lb per sq.ft., provide hold-down clips spaced 2'-0" o.c. on all cross tees.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical tile ceilings.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Testing Substrates: Before installing adhesively applied tiles on wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.
B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION, SUSPENDED ACOUSTICAL TILE CEILINGS

A. General: Install acoustical tile ceilings to comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
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 to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   3. 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.
   4. 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.
   5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
   6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
   7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
   8. Do not attach hangers to steel deck tabs.
   9. Do not attach hangers to steel roof deck. Attach hangers to structural members.

10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical tiles.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Arrange directionally patterned acoustical tiles as follows:
1. Install tiles with pattern running in one direction parallel to long axis of space.

## 3.4 CLEANING

A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

**END OF SECTION 09 51 23**

# SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:
   1. Resilient base and accessories.
B. Related Sections:
   1. Division 09 for additional flooring sections.

### 1.3 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Samples for Initial Selection: For each type of product indicated.

### 1.4 QUALITY ASSURANCE

A. Single-Source Responsibility for Products: Obtain each type and color of product specified from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

### 1.5 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.
B. Deliver products to Project site in original manufacturer's unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.
C. Move products into spaces where they will be installed at least 48 hours in advance of installation.

### 1.6 PROJECT 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. 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.

D. Do not install products until they are at the same temperature as that of the space where they are to be installed.
E. Close spaces to traffic during installation of products specified in this Section.
F. Sequencing and Scheduling: Sequence installing products specified in this Section with other construction to minimize possibility of damage and soiling during remainder of construction period.

## 1.7 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. Furnish not less than 10 linear feet for every fraction thereof, of each type, color, pattern, and size of resilient product installed.

# PART 2 - PRODUCTS

## 2.1 RESILIENT BASE

A. Rubber Base:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Armstrong World Industries, Inc.
      b. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
      c. Flexco, Inc.
      d. Johnsonite.
      e. Roppe Corporation, USA.
      f. VPI, LLC; Floor Products Division.
   2. Resilient Base Standard: ASTM F 1861.
   3. Material Requirement: Type TS (Thermoset Vulcanized Rubber).
   4. Manufacturing Method: Group I (solid, homogeneous).
   5. Style: Cove base with toe.
   6. Minimum Thickness: 0.125 inch.
   7. Height: RB-1 = 4”
   8. Lengths: Coils in manufacturer's standard length. (4’ pieces are not acceptable)
   9. Outside Corners: Preformed.
   10. Inside Corners: Job formed.
   11. Finish: As selected by Architect from manufacturer's full range.
   12. Colors and Patterns: As selected by Architect from full range of industry colors.

## 2.2 VENTED COVE WALL BASE

A. Rubber Base:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Tarkett by Johnsonite
      b. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
      c. Flexco, Inc.
      d. Roppe Corporation, USA.
      e. VPI, LLC; Floor Products Division.
   2. Resilient Base Standard: ASTM F 1861.
   3. Material Requirement: Type TS (Thermoset Vulcanized Rubber).
   4. Manufacturing Method: Group I (solid, homogeneous).

5. Style: Vented cove base with toe. Back surface grooved with vertical semi-circular vent.
6. Minimum Thickness: 0.260” (6.60 mm) by 0.300” (7.62 mm) thick toe.
7. Height: RB-1 = 4”
8. Lengths: Coils in manufacturer's standard length. (4’ pieces are not acceptable)
9. Outside Corners: Preformed.
10. Inside Corners: Job formed.
11. Finish: As selected by Architect from manufacturer's full range.
12. Colors and Patterns: As selected by Architect from full range of industry colors.

## 2.3 RESILIENT ACCESSORIES

A. Resilient Floor Transition Accessories:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Schluter
      b. Or approved equal.
B. Description: Edge for glue-down applications, Reducer strip for resilient floor covering, Transition strips.
C. Material: Unless otherwise noted use Stainless Steel Metal transition strips.
D. At terrazzo tile to existing finish locations only use zinc transition strips.
E. Profile and Dimensions: As indicated.
F. Colors and Patterns: All available finishes.

## 2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
   1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
      a. Cove Base Adhesives: Not more than 50 g/L.
C. Floor Polish: Provide protective liquid floor polish products as recommended by resilient stair tread manufacturer.

# 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.
B. 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.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
   4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
      a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
      b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are same temperature as the space where they are to be installed.
   1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

## 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 practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Outside Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Inside Corners:
   1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
   2. Inside Corners: Use straight pieces of maximum lengths possible. Form inside corners on job from straight pieces of maximum lengths possible by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce snug fit to substrate.

## 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 carpet and resilient floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
B. Perform the following operations immediately after completing resilient product 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 resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
   1. Apply protective floor polish to resilient accessories that are free from soil, visible adhesive, and surface blemishes.
   2. Coordinate selection of floor polish with Owner's maintenance service.
   3. Cover resilient accessories on floors and stairs with undyed, untreated building paper until inspection for Final Acceptance.
D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.
   1. Apply three coat(s).
E. Cover resilient products until Substantial Completion.
F. Clean products specified in this Section not more than 4 days prior to dates scheduled for inspections intended to establish date of Final Acceptance in each area of Project. Clean products using method recommended by manufacturer.
   1. Strip protective floor polish that was applied after completing installation, prior to cleaning.
   2. Reapply floor polish after cleaning.

**END OF SECTION 09 65 13**

# SECTION 09 65 19 - RESILIENT TILE FLOORING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:
   1. Vinyl Composition Floor Tile.
B. Related Sections:
   1. Division 09 Section "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.

### 1.3 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Shop Drawings: Provide VCT shop drawing layout. Show the following:
   1. Columns, doorways, enclosing walls, or partitions, built-in cabinets.
   2. Existing flooring materials to be removed.
   3. Existing flooring materials to remain.
   4. Type of subfloor.
   5. Type of installation.
   6. Pattern of installation.
   7. Type, color, and location of insets and borders.
   8. Type, color, and location of edge, transition, and other accessory strips.
   9. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color label each sample with manufacturer’s name, material description, color, pattern, and designation indicated on Drawings and in schedules.
D. For each type of floor tile indicated.
E. Product Schedule: For floor tile. Use same designations indicated on Drawings.
F. Qualification Data: For qualified Installer.
G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency.
H. Maintenance Data: For each type of floor tile to include in maintenance manuals. Include the following:
   1. Methods for maintaining floor tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
I. Warranty: Provide material warranty information on floor tile.

### 1.4 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.

B. Single-Source Responsibility for Floor Tile: Obtain each type, color, and pattern of tile from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. 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 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.
B. Deliver tiles and installation accessories to Project site in original manufacturer's unopened cartons and containers each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.
C. Store tiles on flat surfaces. Move tiles and installation accessories into spaces where they will be installed at least 48 hours in advance of installation.

## 1.6 PROJECT 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 floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.
B. Do not install tiles until they are at the same temperature as the space where they are to be installed.
C. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
D. Close spaces to traffic during floor tile installation.
E. Close spaces to traffic for 48 hours after floor tile installation.
F. Install floor tile after other finishing operations, including painting, have been completed.
G. Do not install tiles over concrete slabs until the slabs have cured and are sufficiently dry to bond with adhesive as determined by tile manufacturer's recommended bond and moisture test.

## 1.7 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. Floor Tile: Furnish 1 box for every 25 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

# PART 2 - PRODUCTS

## 2.1 VINYL COMPOSITION FLOOR TILE – VCT-1, VCT-2, and VCT-3

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   1. Basis of Design: Armstrong Excelon Imperial Texture Tile
      a. Armstrong World Industries, Inc.
      b. Or manufacturer approved equal.
B. Tile Standard: ASTM F 1066, Class 2, homogeneous, with color extending throughout thickness.
C. Tile Surface: Smooth

D. Overall/Wear Layer Thickness: 1/8 in. (3.2mm)
E. Size: 12 by 12 inches
F. Colors and Patterns: As selected by Architect from manufacturer's full range of industry colors.
G. Refer to drawings for the number of different colors to provide. Refer to drawings for pattern.

## 2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
B. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.
   1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
      a. Vinyl Composition Floor Tile Adhesives: Not more than 50 g/L.
C. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.
D. Concrete Slab Primer: Nonstaining type as recommended by flooring manufacturer.

# 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.
B. 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.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
   4. Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
      a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
      b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.
C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
D. Do not install floor tiles until they are same temperature as space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

F. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

G. Apply concrete slab primer, if recommended by flooring manufacturer, prior to applying adhesive. Apply according to manufacturer's directions.

## 3.3 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.

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 tiles with grain direction alternating in adjacent tiles (basket-weave pattern).

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, nonstaining marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor 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 flooring 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. Use full spread of adhesive applied to substrate in compliance with tile manufacturer's directions including those for trowel notching, adhesive mixing, and adhesive open and working times.

J. Hand roll tiles where required by tile manufacturer.

## 3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of 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.
4. Do not wash floor until after time period recommended by resilient floor tile manufacturer.

C. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.

1. Apply three coat(s).
2. Use commercially available, metal, cross-linked acrylic product acceptable to tile manufacturer.
3. Coordinate selection of floor polish with Owner's maintenance service.
4. The Contractor shall inspect tiles and remove and discard any and all tiles that telegraph imperfections from subfloor. Correct deficiency in subfloor surface and replace with new tile.

E. Joint Sealant: Apply sealant to resilient terrazzo floor tile perimeter and around columns, at door frames, and at other joints and penetrations.

F. Sealers and Finish Coats: Remove soil, visible adhesive, and surface blemishes from resilient terrazzo floor tile surfaces before applying liquid cleaners, sealers, and finish products.
   1. Sealer: Apply two base coats of liquid sealer.
   2. Finish: Apply three coats of liquid floor finish.

G. Cover floor tiles with undyed, untreated building paper until Substantial Completion.

H. Do not move heavy and sharp objects directly over tiles. Place plywood or hardboard panels over tiles and under objects while they are being moved. Slide or roll objects over panels without moving panels.

I. Clean tiles not more than 4 days prior to dates scheduled for inspections intended to establish date of Final Acceptance in each area of Project. Clean tiles using method recommended by manufacturer.
   1. Strip protective floor polish that was applied after completing installation prior to cleaning.
   2. Reapply floor polish after cleaning.
   3. The Architect will inspect tiles at this time and mark tiles that may still telegraph imperfections from subfloor with a permanent marker. Remove marked tiles, correct deficiency in subfloor surface and replace with new tile.
   4. After above procedure is complete apply an additional minimum of two (2) coats of final polish acceptable to the tile manufacturer and the Owner's maintenance service.

**END OF SECTION 09 65 19**

# SECTION 09 65 90 – RESILIENT WOOD FLOORING 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 flooring system for Gymnasium
B. Related Sections include the following:
   1. Division 03 Section “Cast-in-Place Concrete” for concrete slab.
   2. Division 11 Section "Gymnasium Equipment" for sleeves to be installed within flooring system.

### 1.3 SUBMITTALS

A. Shop Drawings: Indicate installation details including location and layout of each type of floor assembly and accessory; expansion provisions and trim details; layouts, colors, widths, and dimensions of game lines and markers; and locations of floor inserts for athletic equipment installed through flooring assembly.
B. Product Data: Submit construction details, material descriptions, dimensions of individual components and profiles, and finishes for wood athletic floor assemblies.
C. Samples: Submit two manufacturer’s color charts showing colors and glosses available for floor finish and game-line and marker paint.
D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

### 1.4 QUALITY ASSURANCE

A. Source Limitations: For field-finished wood flooring, obtain each species, grade, and cut of wood from one source with resources to provide materials and products of consistent quality in appearance and physical properties.
B. Maple Flooring: Comply with applicable MFMA grading rules for species, grade, and cut.
   1. Certification: Provide flooring that carries MFMA mark on each bundle or piece.
C. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.
D. Installer: Company specializing in performing work of this section with minimum five years documented experience and approved by manufacturer.
E. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to athletic flooring.

### 1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in manufacturer’s original packaging. Inspect for damage.
B. Protect wood flooring from exposure to moisture. Do not deliver wood flooring until after concrete, masonry, plaster, ceramic tile, and similar wet work is complete and dry.
C. Store wood flooring materials in a dry, warm, ventilated, weathertight location.

1.6 PROJECT CONDITIONS

A. Conditioning period begins not less than seven days before wood flooring installation, is continuous through installation, and continues not less than seven days after wood flooring installation.
   1. Environmental Conditioning: Maintain an ambient temperature between 65 and 75 deg F and relative humidity between 35 and 50 percent.
   2. Wood Flooring Conditioning: Move wood flooring into spaces where it will be installed, no later than the beginning of the conditioning period.
      a. Do not install flooring until it adjusts to relative humidity of, and is at same temperature as, space where it is to be installed.
      b. Open sealed packages to allow wood flooring to acclimatize immediately on moving flooring into spaces in which it will be installed.

B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.

C. Install factory-finished wood flooring after other finishing operations, including painting, have been completed.

D. Verify field measurements prior to fabrication.

1.7 WARRANTY

A. Materials:
   1. The flooring shall be covered by the manufacturer against product defects for one (1) years from substantial completion.

B. Installation:
   1. The installation of the flooring shall be covered against poor workmanship and faulty installation by a one (2) year written, limited warranty provided by the contractor performing/overseeing the installation

1.8 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Wood Flooring: Equal to **1** percent of amount installed for each type of wood flooring indicated.

PART 2 - PRODUCTS

2.1 RESILIENT WOOD FLOORING SYSTEMS: Drawing Symbol WFL

A. Available Manufacturers: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   1. Basis of Design – “Duracushion I” by Connor Sports Flooring or equal by but not limited too:
      a. Aacer Flooring, LLC
      b. Action Floor Systems
      c. Horner Flooring Company
      d. Robbins, Inc
      e. or equal

B. Product Description:
   1. Gymnasium: Maple flooring over plywood subfloor with resilient pads over vapor retarder on slab-on-grade.
      a. Finishing: One coat sealer and three coats finish. Game lines painted over sealer and under finish coats.

C. Concrete Subfloor
   1. Depress slab 2 1/8". Verify depression with manufacturer.

## 2.2 COMPONENTS

A. Wood Flooring: Northern Hard Maple.
   1. Grade: Second and better.
   2. Cut: Edge.
   3. Moisture Content: 7 to 9 percent.
   4. Actual Thickness: 25/32 inch.
   5. Actual Width: 2-1/4 inch.
   6. Edge: Tongue and groove.
   7. End: End matched.
   8. Length: Random, minimum of 9 inches.

B. Subfloor: 15/32 inch thick plywood, APA Rated Sheathing with square edges, C-D faces, Exposure 1; unsanded.

C. Underlayment: 15/32 inch thick plywood, APA B-C faces, with square edges, Exposure 1; sanded.

D. Resilient Pads: Rubber material, unsealed air slots for resiliency; 2-1/4 x 3 inch size, 3/8 inch thick.

## 2.3 ACCESSORIES

A. Vapor Retarder: Polyethylene, 6 mil thick.

B. Vapor Retarder Tape: Type recommended by manufacturer.

C. Vented Wall Base: Molded rubber, 4 inches high with 3 inch toe, ventilated type, with pre-molded outside corners.

D. Flooring Nails: Type recommended by flooring manufacturer.

## 2.4 FINISH MATERIALS

A. Gymnasium:
   1. Sealer: Water based urethane surface-type seal.
      a. Hillyard Basecoat or equivalents by Betco Corp. or The Sika Corporation.
   2. Top Coats: Water based epoxy.
      a. Hillyard Contender Gym Finish or equivalents by Betco Corp. or The Sika Corporation.
   3. Game Lines: Stain compatible with sealer and top coats.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of wood flooring.
   1. Verify that substrates comply with tolerances and other requirements specified in other Sections.
   2. Verify slab-on-grade is ready for installation of flooring system.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Substrate Moisture Testing, General: Perform tests recommended by manufacturer.
   1. Proceed with installation only after substrates pass testing.

3.2 PREPARATION

A. Grind high spots and fill low spots on concrete substrates to produce a maximum 1/8-inch deviation in any direction when checked with a 10-foot straight edge.
   1. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

B. Broom or vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Install vapor retarder over the entire slab-on-grade. Lap joints 6 inches minimum and seal joints with tape.

B. Install lower layer of subfloor perpendicular to finish maple flooring, spacing all edges 1/4” and stagger joints 4’. Provide 1-1/2” expansion voids at perimeter and at all vertical obstructions. The underside of first layer shall have resilient pads attached 12” on center (32 per sheet) and 6” from edges on all sides. Install solid blocking at doorways, under bleachers in the stacked position, and below portable goals.

C. The second layer of subfloor shall be laid at a 45-degree angle over the first layer, spacing all edges 1/4” and stagger joints 4’. Provide 1-1/2” expansion voids at perimeter and at all vertical obstructions. Attach second layer of subfloor with fasteners 12” on center.

D. Maintain two inch expansion void at walls and all vertical obstructions.

E. Install solid blocking under bleachers in the stacked position and along the extended position.

F. Install Gymnasium flooring parallel with main playing court. Nail at 12 inches o. c. maximum. Space joints between flooring strips to allow for intermediate expansion, in accordance with local humidity conditions. Maintain 1-1/2” expansion void at walls and all vertical obstructions.

G. Install vented base after all finish work is complete. Miter interior corners and use pre-molded outside corners.

3.4 FINISHING

A. Sanding:
   1. Machine sand with course, medium, and fine grade sandpaper to a smooth, even, uniform surface.
   2. After sanding, buff entire floor using 100 grit screen or equal grit sandpaper, with a heavy-duty buffing machine.
   3. Remove sanding dust from entire surface by tack or vacuum.

B. Finishing:
   1. Apply two (2) coats sealer to entire floor.
   2. After applying game lines, apply three (3) coats of finish.
   3. After each coat is dry, buff, vacuum and tack between each coat.

C. Game Lines:
   1. Apply game lines in accordance with approved drawings.
   2. Apply game lines straight and true with crisp edges.
   3. Main court lines are to be continuous. Stop other court lines one inch short of main court lines.
      a. Main basketball court lines are continuous. Main volleyball court lines are secondary and will break at main basketball court lines.

3.5 PROTECTION

A. Protect installed wood flooring during remainder of construction period with covering of heavy kraft paper or other suitable material. Do not use plastic sheet or film that might cause condensation.

1. Do not move heavy and sharp objects directly over kraft-paper-covered wood flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

**END OF SECTION 09 65 90**

# SECTION 09 66 23 – TERRAZZO TILE FLOORING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
   1. Terrazzo Floor Tile
   2. Precast, terrazzo accessories.
   3. Related accessories.

B. Related work not specified under this section:
   1. Concrete Floors: Section: 03 30 00.
   2. Terrazzo Floor Restoration Section 09 01 60 91.

### 1.2 COORDINATION

A. Note during demolition the General Contractor is to salvage a piece of the existing terrazzo and turn material over to the Architect so that the existing terrazzo thickness can be field verified and new terrazzo tile thickness can be determined by Architect.

B. Coordinate the types of traffic allowed to terrazzo between the following events:
   1. Completion of pouring and before coarse grinding.
   2. Completion of grouting and before polishing.

C. Setting material, grouts sealants and caulks

D. Coordinate the preparation for terrazzo work with the installation of plumbing, electrical, communications, and electrical/data work in the floor area to receive terrazzo.

E. Installation of terrazzo tiles

### 1.3 PREINSTALLATION MEETING

A. Pre-installation Conference: Conduct conference at Project site Review methods and procedures related to terrazzo.
   1. Review methods and procedures related to terrazzo including, but not limited to, the following:
      a. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
      b. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
      c. Review special terrazzo designs and patterns.
      d. Review dust-control procedures.

      e. Review plans for concrete curing and site drying to enable timely achievement of suitable slab moisture conditions.

1.4 SUBMITTALS

A. Product Data: Manufacturer's product data for each type of terrazzo and accessory including the following information:

B. Shop Drawings: Include terrazzo installation requirements. Include plans, elevations, sections, component details, and attachments to other work. Show layout of the following:
1. Existing flooring materials to be removed.
2. Type of subfloor.
3. Type of installation.
4. Divider strips.
5. Accessory strips.
6. Type, color, and location of edge, transition, and other accessory strips.
7. Transition details to other flooring materials.
8. Control-joint and expansion-joint strips.
9. Base and Border strips.
10. Terrazzo patterns.

C. Samples for Initial Selection: Provide 6"x6" color samples for Architect review.

D. Samples for Verification: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected. Label each terrazzo sample to identify manufacturer's matrix color and aggregate types, sizes, and proportions. Prepare samples of same thickness and from same material to be used for the Work in size indicated below:
1. Terrazzo: 6-inch square samples of each color and type.
2. Accessories: 6" length of each kind of divider strip, stop strip, and control joint strip required.

E. Qualification Data: For Installer.

F. Material Certificates: For each type of terrazzo flooring system product, provide supplier or manufacturer's written certificate stating that materials comply with or exceed NTMA specified properties and performance requirements of this section.

G. Material Test Reports: For moisture and / or relative humidity of substrate, by a qualified testing agency.

H. Precast Terrazzo Flooring Test Reports: Provide test reports for precast terrazzo flooring, for the following tests performed by manufacturer and witnessed by a qualified testing agency.:
1. Compressive Strength: ASTM D695.
2. Water Absorption: ASTM C373/ASTM C140
3. Flexural Strength: ASTM D638
4. Tensile Strength: ASTM D638.

I. Provide Information on flexible crack isolation membrane.

J. Sample Warranties: For manufacturer's special warranties.

1.5. CLOSEOUT SUBMITTALS

A. Maintenance Data: NTMA maintenance recommendations and manufacturer's instructions to include in

maintenance manuals.

B. Repair Procedures: Provide written procedures for the following.
1. Precast Terrazzo Flooring: Removing individual precast units and replacing them.

1.6 REFERENCES

A. American Society for Testing and Materials (ASTM)
1. ASTM C-140, C-150, C-293, C-373, C-482, C-485, C-499, C-502, C-609, C-648, C-650, C-674, C-1243, C-1378, C-1523
2. ANSI A137.1 9.6 section.

B. Tile Council of America (TCNA)
1. Tile Council of North America (TCNA) Handbook – latest edition

C. American National Standards Institute (ANSI)
1. ANSI A108.1 thru A108.17
2. ANSI A118.1 thru A118.15

1.7 QUALITY ASSURANCE

A. Source Limitations:
1. Obtain primary epoxy terrazzo flooring system materials including membranes, primers, moisture vapor primers, resins, and hardening agents from a single manufacturer.
2. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.
3. Manufacturer must provide history of providing primary materials for a minimum of 10 years
4. Obtain divider strips, sealers, cleaners from source recommended by primary materials manufacturer.
5. Obtain aggregates of each color, grade, type, and variety of granular materials from one source with resources to provide materials of consistent quality in appearance and physical properties.

B. Testing shall be conducted according to ASTM F2170 only to determining relative humidity in concrete slabs using in situ probes.

**C. Setting and Grouting Materials: Provide materials obtained from one source for each type and color of grout and setting materials.**

**D. TCNA Standards: Comply with specifications under the current Handbook for Tile Installation.**

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to Project site in supplier's original upopened packaging, wrappings and containers, labeled with source's or manufacturer's name, material, size, color or product brand name, and lot number if any.

B. Report all damage due to shipment immediately. The customer is required to sign the Bill of Lading slip noting the damaged product. Picture proof is required.

C. Nominal 24” x 24” tiles are boxed, banded and palletized and tiles are crated.

D. Store materials in their original, undamaged packages and containers, inside a climate-controlled environment, a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
   1. Storage temperatures should be per manufacturer's recommendations.
   2. Do not use materials which have been stored for a longer period of time than the manufacturer's maximum recommended shelf life.
      Protect from damage by other trades.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by the installation materials manufacturer for optimum results. Do not install products under environmental conditions outside the installation material manufacturer's absolute limits.

B. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.

C. Terrazzo contractor to verify project conditions prior to installation of floor. Verification includes but not limited to the following:
   1. Verify that following has been provided by the General Contractor: water, 220 volt single phase 100 amp breaker & 480 volt 3 phase 60 amp breaker electrical services with hookups and disconnects within 200 feet of any terrazzo area.
   2. General Contractor shall be responsible for scheduling and conducting an independent test to determining relative humidity in the concrete slabs using in situ probes. Number and location of tests shall be verified with the terrazzo contractor.

D. Field Measurements: Verify actual dimensions of construction contiguous with precast terrazzo by field measurements before fabrication.

E. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.

F. Close spaces to traffic during terrazzo application and for not less than 24 hours after application unless manufacturer recommends a longer period.

G. Control and collect dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.
   1. Provide dustproof partitions and temporary enclosures to limit dust migration and to isolate areas from noise.

H. Terrazzo contractor shall, prior to surface preparation:
   1. Evaluate slab condition, including slab moisture content and extent of any required repairs.
   2. Maintain the ambient room temperature at 60ºF and floor/slab at 50°F or above for a period extending 72 hours before, during, and after floor installation. Concrete to receive epoxy terrazzo shall have cured for at least 28 days and be free of all curing compounds (unless moisture vapor primer is incorporated into the system). Test concrete substrate to determine acceptable moisture levels prior to installation.

I. Acceptable Substrates:
   1. Flatness tolerance: Concrete subfloor shall be flat with a maximum variation from level of 1/4" in any 10 feet. Any irregularity of the surface requiring patching and / or leveling shall be done using an appropriate terrazzo fill and selected aggregates as recommended by NTMA resin systems.

2. Concrete floor shall be prepared mechanically by shot blasting. Grinding of slab is not sufficient surface preparation. Surface preparation results should achieve a CSP3-CSP5 profile according to International Concrete Repair Institute Guideline No. 03732.
3. Concrete floor shall receive a steel trowel finish.
4. Concrete shall be cured a minimum of 28 days. No curing agents are to be used in areas to receive terrazzo.
5. Concrete slab shall have an efficient moisture vapor barrier directly under the concrete slab. Moisture barrier shall NOT be punctured.
6. Saw cutting of control joints must be done between 12 – 24 hours after placement of the structural concrete and at a minimum of 1/2 the concrete thickness.

J. Provide protection from other trades prior to final acceptance by Owner.

K. It is preferred that any drywall be installed after the terrazzo is rough ground. If schedule dictates otherwise, be installed 3/4" above the terrazzo thickness to prevent wicking during the polish grinding wet process.

1.10 WARRANTY

A. Manufacturer/Installer shall warrant installed terrazzo tile and accessories for a period of 1 year from the date of substantial completion against product defects.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the following:
1. Wausau Tile Inc.
2. Master Terrazzo Technologies
3. Dynamic Terrazzo

B. Source Limitations: Obtain primary Epoxy Terrazzo Flooring System materials including membranes, primers, resins, and hardening agents from a single manufacturer.
1. Obtain aggregates, solvents, divider strips, sealers and cleaners from source recommended by primary materials manufacturer.

2.2. PERFORMANCE REQUIREMENTS

A. NTMA Standards: Comply with NTMA's "Terrazzo Specification and Design Guide" and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.

2.3. MATERIALS

A. Terrazzo Tile (TRZT): Material terrazzo tile colors and aggregates to be selected by Architect.

B. Epoxy Resin

C. Aggregates: All aggregates to meet ASTM C-33 specifications, cleaned and properly graded to size. Aggregate shall be blended to meet individual project requirements.

1. The aggregates used have a natural color range and come in a variety of sizes and colors. Therefore, the aesthetic class/shade range as per ASTM test C609 will vary from a V1 rating to a V2 rating.

2. The aggregates used have a natural color range. This can cause slight variances in overall color. Tiles should be blended at the job site from several cartons/pallets during installation.

D. Marble chips, size to conform with NTMA gradation standards.

E. Physical Properties without Aggregates:
1. Hardness: ASTM D2240 70-85 Shore D
2. Minimum Tensile Strength: 4,800 psi per ASTM D638 for a 2-inch specimen made using a "C" die per ASTM D412.
3. Minimum Compressive Strength: 12,000 psi per ASTM D695 Specimen B cylinder.

4. Chemical Resistance: Not deleterious effects by contaminant listed below after 7 day immersion at room temperature per ASTM D1308.
   a. Distilled Water
   b. Mineral Water
   c. Isopropanol
   d. Ethanol
   e. 0.025 percent detergent solution
   f. 10 percent sodium hydroxide
   g. 10 percent hydrochloric acid
   h. 5 percent acetic acid

F. Physical Properties with Aggregates: For resin blended with Georgia White marble, ground, grouted, and cured per requirements in NTMA's "Guide Specification for Epoxy Terrazzo," comply with the following:
1. Flammability: Self-extinguishing, maximum extent of burning 0.25 inch per ASTM D635.
2. Linear Coefficient of Thermal Expansion: 25.0x10-6 in/in per ºF for temperature range of -12° to 140° F per ASTM D696.
3. Bond Strength: When tested in accordance with Field Test Method for surface soundness and adhesion as described in ACI Committee No. 403 Bulletin Tile No. 59-43 the Epoxy terrazzo shall comply with the following value: 100 percent concrete failure minimum, with 300 psi minimum tensile strength.

G. Coloring: Pigments used shall be inorganic, resistant to alkalinity, and used per the manufacturer's recommendations.

H. Caulks & Sealants:

a. Urethane or Polyurethane Sealant
b. Color to be selected by Architect from the standard color pallet.

I. Cleaner: Liquid neutral chemical cleaner, with a pH factor between 7 and 8, of the following:
a. formulation recommended by sealer manufacture for the type of precast terrazzo
b. used and complied with NTMA requirements.

J. Sealer: To be applied to the terrazzo tile after installation.

2.4 MANUFACTURED UNITS

1. Precast Surfaces and Edges:
   a. Chamfered face edges
   b. Surfaces to be uniform in appearance and free of blemishes.

2. Match Master Terrazzo Technologies Matrix with 100% GA WHITE Marble #0s.
   a. Custom Colors or Color Matching prepared by request. It is the responsibility of the Architect, Designer or Owner to approve tile samples and corresponding precast samples prior to manufacturer.

   b. Finish/Texture:
      1. Factory Polish or Honed.
      2. Back of tile will be ground flat and free from protrusions

   c. Terrazzo Tile Size: 24x24

   d. Thickness: The General Contractor to salvage a piece of the existing terrazzo and turn material over to the Architect so that the existing terrazzo thickness can be field verified and new terrazzo tile thickness can be determined by Architect.

2.5 FABRICATION

A. Mechanically vibrated in molds.
B. Factory finish: In-line back and face grinding.
C. Factory applied initial protectant.
D. Packaged and palletized.

2.6 STRIP MATERIALS

A. Threshold/Divider Strips:
   1. L-Type or T-Type or per manufacturer recommendations.
      a. Material: Zinc Alloy.
      b. Location: Existing wood flooring to new terrazzo tile.
      c. Location: Existing terrazzo to new terrazzo tile.
      d. Location: Existing Terrazzo to sealed concrete.
      e. Location: Refer to drawings.

B. Threshold/Divider Strips:
   1. Reno-U or Reno Ramp or per manufacturer recommendations.
      a. Use RENO-U by Schluter if ½” height or less and RENO Ramp if 9/16” height or more.
      b. Material: Refer to manufacturer for recommended material type.
      c. Location: Existing Terrazzo to sealed concrete.
      d. Location: Refer to drawings.

C. Control-Joint Strips: Separate double L-type angles, positioned back to back with minimum 1/8” – 1/4” width between. (Single L-type angle, positioned adjacent to the joint is also acceptable.) Fill joint with 100% solids epoxy joint filler. Fill area between strips with elastomeric joint filler. Match material, thickness, and color of divider strips and depth required for topping thickness indicated. (For buried control joint): Fill saw cut concrete control joint with 100% solids epoxy filler, apply Iso-Crack Membrane 30-40 mils, embed 12" fiberglass fabric reinforcement. Saw cut control joints should be

prefilled with hard epoxy and a single "L" divider with the vertical part placed precisely over the cut. If the saw cut control joint opening is 1/4" or wider, the strip treatment should be as a cold-pour construction below.

D. Construction-Joint (Cold-Joint) Strips: Separate double L-type angles back to back with minimum 1/8" – 1/4" width between. Fill joint and area between strips with elastomeric joint filler. Match material, thickness, and color of divider strips and depth required for topping thickness indicated.

E. Isolation-Joint Strips: Separate double L-type angles, positioned back to back with minimum 1/8" – 1/4" width between. Fill area between strips with elastomeric joint filler. Match material, thickness, and color of divider strips and depth required for topping thickness indicated

2.7 MISCELLANEOUS ACCESSORIES

A. Strip Adhesive: Epoxy-resin adhesive recommended by adhesive manufacturer for this use and acceptable to terrazzo manufacturer.
   1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Patching and Fill Material: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated and by NTMA Resin Systems.

C. Joint Compound: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated. Color to be selected by architect to match and/or compliment terrazzo

D. Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by sealer manufacturer for use on terrazzo type indicated.

E. Sealer: Slip- and stain-resistant penetrating-type sealer that is chemically neutral with pH factor between 7 and 10; does not affect color or physical properties of terrazzo; is recommended by sealer manufacturer; and complies with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated.

F. Moisture Vapor Barrier and Primer: Where environmental criteria described in 1.6,B cannot be achieved, GC is to provide moisture vapor barrier and primer compatible with the epoxy terrazzo system being installed so as to achieve a warranted installation.

2.8 THRESHOLDS

A. Refer to drawings for threshold transition strips.
B. For thresholds the maximum height is ½ inch, when beveled with a slope not steeper than 1:2.
C. Note floor finish level greater than ½ inch in height shall be ramped.
D. When the floor finish level is greater than a half inch and a floor leveling compound is required use the manufacturer recommended floor leveling compound to achieve a level floor finish.

PART 3 - EXECUTION

3.1 SOURCE QUALITY CONTROL

A. Examine substrates and areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions, including levelness tolerances, have been corrected.

C. Inspections: Documented inspection of Terrazzo Tile quality control tests.

D. In-house testing is completed on the first day's production and every 5,000 square feet after for all projects.
a. Compression - ASTM C140 > 13,000 psi average
b. Absorption - ASTM C140 < 5% average
c. Flexural - ASTM C293 > 1000 psi average
d. Specular Gloss Testing at 60 degrees - ASTM D523
e. Stain testing/initial protection testing.

E. All projects over 10,000 square feet will have one set of tests sent to a third-party test lab.

## 3.2 TEST RESULTS

A. Independent Test Lab completed and verified the following data:

a. 24 x 24 Epoxy Tile

1. C373 Water Absorption – Passes (Semi-Vitreous)
2. C482 Bond Strength - > 300 psi.
3. C485 Warpage Edge +/- .001% or .002 in.
4. C485 Warpage Diagonal +/- .003% or .010 in.
5. C499 Nominal Size - range of .029 in. vi. C499 Thickness - range of .029 in.
6. C502 Wedging +/- .023% or .028 in. viii. C609 Color Uniformity - V1 – V2
7. C648 Breaking Strength - > 500 lbs.
8. C650 Resistance to Chemical Substance- not affected
9. C674 Flexural properties - > 1000 psi. average
10. Dynamic DCOF – after coating methods are applied
11. ANSI A137.1 Section 9.6.1 "Wet Dynamic Coefficient of Friction (DCOF)"
12. Average Polished Finish = .46 / Average Honed Finish = .54
13. C1243 Deep Abrasion Wear – passes (meets p3 standards)
14. C1378 Resistance to staining - not affected.

## 3.3 PREPARATION

A. Clean substrates of substances, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.

B. Concrete Slabs:
1. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo.
   a. Prepare concrete mechanically by shot-blasting. Grinding of slab is not sufficient surface preparation, except for edges and corners not accessible with shot blasting equipment. Surface preparation results should achieve a CSP3-CSP5 profile according to International Concrete Repair Institute Guideline No. 03732.
   b. Repair or flatten damaged and deteriorated concrete according to Terrazzo Resin Systems Technical Bulletin 008 Substrate Leveling Requirements for Thin-Set Epoxy Terrazzo
   c. Repair cracks and non-expansion joints greater than 1/16" wide according to Resin Systems Technical Bulletin 009 Crack Detailing and Joint Treatments Resin Thin-set Epoxy Terrazzo.
   d. Use patching and fill material to fill holes and depressions in substrates according to terrazzo manufacturer's written instructions.

2. Verify that that concrete substrates are visibly dry and free of moisture.

3. Moisture Testing:
   a. Test for moisture according to ASTM F2170 (determining relative humidity in concrete slabs using in situ probes). Proceed with installation only after substrates have a maximum relative humidity measurement reading less than 80%. If relative humidity measurement reading is greater than or equal to 80% moisture vapor primer (MVP) is recommended. Apply to terrazzo substrates according to resin systems MVP product data sheet.

C. Protect other work from dust generated by grinding operations. Control dust to prevent air pollution and comply with environmental protection regulations.
   1. Erect and maintain temporary enclosures and other suitable methods to limit dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

D. Installation of terrazzo indicates acceptance of surfaces and conditions.

## 3.4 INSTALLATION

A. General:

1. Comply with NTMA's written recommendations for terrazzo and accessory installation.
2. Place, rough grind, grout, cure grout, fine grind, and finish terrazzo according to manufacturer's written instructions and NTMA's "Terrazzo Specifications and Design Guide."
3. Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.
4. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.

B. Thickness: To be determined by Architect. The General Contractor is to salvage existing terrazzo sample and turn material over to Architect so that material thickness can be determined by Architect.

C. Moisture Vapor Primer (MVP): If required, apply to terrazzo substrates according to resin systems moisture vapor primer product data sheet.

D. Primer: Apply to terrazzo substrates according to manufacturer's written instructions.

E. Flexible Reinforcing Membrane.
   1. Prepare membrane according to manufacturer's written instructions before applying substrate primer.
   2. Membrane application for isolated cracking. Route out all cracks and fill with 100% solids epoxy. Apply Iso-Crack Epoxy Membrane (spread at 40 mils thickness) across the crack allowing a minimum of 9 inches on either side. Embed fiberglass scrim into wet membrane and saturate with additional membrane.

F. Strip Materials:
   1. Divider and Control-Joint Strips:
      a. Install strips in adhesive setting bed without voids below strips or mechanically anchor strips as required to attach strips to substrate.
      b. Control-Joint Strips: Separate double L-type angles, positioned back to back with minimum 1/8" – 1/4" width between. (single L-type angle, positioned adjacent to the joint is also acceptable.) Fill joint with 100% solids epoxy joint filler. Fill area between strips

with elastomeric joint filler. Match material, thickness, and color of divider strips and depth required for topping thickness indicated.
1. Buried Control Joint: Fill saw cut concrete control joint with 100% solids epoxy filler. Apply Terroxy Iso-Crack Membrane 30-40 mils, embed 12" fiberglass fabric reinforcement.
2. Eliminate double L and filler at control joints unless opening at saw cut is 1/4' or greater.

2. Construction-Joint (Cold-Joint) Strips: Separate double L-type angles, positioned back to back with minimum 1/8" – 1/4" width between. Fill joint and area between strips with elastomeric joint filler. Match material, thickness, and color of divider strips and depth required for topping thickness indicated.
3. Isolation-Joint Strips: Separate double L-type angles, positioned back to back with minimum 1/8" – 1/4" width between. Fill area between strips with elastomeric joint filler. Match material, thickness, and color of divider strips and depth required for topping thickness indicated.

G. Grouting:
1. Cleanse floor with clean water and rinse.
2. Remove excess rinse water by wet vacuum, dry, and fill voids with resin systems epoxy matrix or clear resin.
3. Allow grout to cure. Grout may be left on terrazzo until other trades work is completed. Remove excess grout with 150 grit diamonds and then follow with 200 grit diamonds.

H. Polishing: Grinding with 400-grit diamonds until all grout is removed from surface. Repeat rough grinding, grout coat, and polishing if large terrazzo chip voids exist after initial polishing. Produce surface with a minimum of 70% aggregate exposure.

I. Repair: Remove and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by Architect.

J. All installations of Terrazzo Tile shall comply with the appropriate Installation method as depicted in the current edition of the Tile Council of North America Handbook for Ceramic, Glass, and Stone Installation.

K. The Architect or other design professional shall select which methods to be specified. All Specifications must also conform to local codes, ordinances, trade practices, and climate conditions.

L. **When setting Epoxy Terrazzo Tile an ANSI A118.4 mortar is required.** The setting materials manufacturer's printed installation instructions are to be followed in every instance.

M. **When setting Epoxy Terrazzo Tile an ANSI A118.4 mortar adhesive is required.** The setting materials manufacturer's printed installation instructions are to be followed in every instance.

**N. A minimum of 95 percent thin-set coverage is recommended on the back of the tile with no voids exceeding two square inches and no voids with 2" of the edges. All corners and edges must be fully supported and back buttering is required on tiles larger than 12" to reach these requirements.**

**O. ANSI A-108.5 installation specifications that correspond with the selected TCNA Installation Method are required. This includes substrate and surface inspections, location and frequency of EJ171 Movement Joint Guidelines, Placement Techniques, and grouting procedures.**
a. Minimum recommended grout joint width is 1/8"
b. Deflection requirement of L/360
c. The maximum allowable substrate variation can be no more the 1/8" in 10' and 1/16" in 24".

P. Applied Initial Protectant

1. When using a heavily pigmented grout, it's recommended to use a grout release prior to grouting. A test area is recommended to ensure the grout release was adequately applied.

2. If a slight grout haze occurs, it can be effectively removed from the tile by using a 3MTM Eraser Pad 3600 Pink pad with water and or 3MTM Neutral Cleaner. A floor buffer is recommended to assist in cleaning.

3. If a more difficult stain occurs, use a Scotch-BriteTM DoodlebugTM Easy Erasing Pad 4610 along with water and or 3MTM Neutral Cleaner. A floor buffer is recommended to assist in cleaning.

4. For additional protectant information and long-term care guidelines, please contact 3M via 1-800-852-9722 or www.3m.com/facility

3.04 CARE & MAINTENANCE

A. Cleaning

1. Dust mop or vacuum to remove sand, dust and other contaminants off the surface.
2. Clean up spills immediately and damp mop lightly soiled floors with a neutral cleaner.
3. For more aggressive cleaning use a mechanical buffer or auto scrubber along with a 3MTM Re-Buffer Pad 5100 and Neutral Cleaner per the manufacturer's recommendations.
4. For cleaning combined with light polishing, the Scotch-BriteTM Purple Diamond Pad Plus may be used on an auto scrubber.
5. DO NOT use acidic cleaners, cleaners that contain citrus (d-limonene), 2-butoxyethanol (butyl cellusolve), amine-based cleaners, isopropyl alcohol, solvent based cleaners, degreasers, or non-neutral cleaners.
6. DO NOT use spray buff products or chemical dust mop treatments.
   RESTROOM APPLICATION – If the product is installed in a residential or commercial restroom additional coat of a topical seal will be required to protect the floor. Restroom applications will also require a more stringent care and maintenance program.
7. Apply product per manufactures published instructions. To ensure maximum performance and expected wear of the sealer, use manufacturer recommended cleaners.

8. Sealing:
   1. Seal surfaces according to NTMA's written recommendations.
   2. Apply two coats of Acrylic (Water base) sealer in accordance with manufacturer's instructions.

9. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure that terrazzo is without damage or deterioration at time of Substantial Completion. Any damage that does occur shall be the responsibility of the General Contractor to repair or replace to the satisfaction of the Architect.

**END OF SECTION 09 66 23**

# SECTION 09 84 33 – SOUND ABSORBING WALL UNITS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section includes shop-fabricated, sound-absorbing acoustical panel units tested for acoustical performance.

### 1.3 SUBMITTALS

A. Product Data: For each type of product.
B. Shop Drawings: For unit assembly and installation.
C. Samples: For each exposed product and for each color and texture specified.
D. Product certificates.
E. Maintenance data.

### 1.4 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 of applicable testing agency.
      a. Flame-Spread Index: 25 or less.
      b. Smoke-Developed Index: 450 or less.
   2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

### 1.5 QUALITY ASSURANCE

A. Single-Source Responsibility for Products: Obtain each type and color of product specified from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

### 1.6 DELIVERY, STORAGE, AND HANDLING

A. Store 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.

B. Deliver products to Project site in original manufacturer's unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.
C. Move products into spaces where they will be installed at least 48 hours in advance of installation.

## 1.7 PROJECT 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. 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 products after other finishing operations, including painting, have been completed.
D. Do not install products until they are at the same temperature as that of the space where they are to be installed.
E. Sequencing and Scheduling: Sequence installing products specified in this Section with other construction to minimize possibility of damage and soiling during remainder of construction period.

# PART 2 - PRODUCTS

## 2.1 SOUND-ABSORBING WALL UNITS

A. Sound-Absorbing Wall Panel: Manufacturer's standard panel construction consisting of facing material laminated to front face, edges, and back edge border of core.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Acoustical Panel Systems, Inc. (APS).
      b. Acoustical Solutions, Inc.
      c. Armstrong World Industries, Inc.
      d. Kinetic Noise Control, Inc.
      e. Tectum Inc.
      f. Wall Technology, Inc.; an Owens Corning company.
   2. Colors and Patterns: As selected by Architect from manufacturer’s standard range of industry colors.
   3. Mounting: Edge mounted with splines secured to substrate.
   4. Core: Manufacturer's standard.
   5. Edge Construction: Manufacturer's standard extruded-aluminum or zinc-coated, rolled steel frame.
   6. Edge Profile: Square.
   7. Corner Detail in Elevation: Square with continuous edge profile indicated.
   8. Nominal Overall Panel Thickness: 2”.
   9. Panel Width: As indicated on Drawings.
   10. Panel Height: As indicated on Drawings.

## 2.2 MATERIALS

A. Core Materials: Manufacturer's standard.
   1. Glass-Fiber Board: ASTM C 612; of type standard with manufacturer, unfaced, and dimensionally stable, molded rigid board; and with maximum flame -spread and smoke developed indexes of 25 and 50, respectively.

B. Facing Material: Fabric from same dye lot; color and pattern as selected by Architect from manufacturer's full range.
C. Mounting Devices: Concealed on back of unit, recommended by manufacturer to support weight of unit.

2.3 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.

B. Core-Face Layer: Evenly stretched over core face and edges and securely attached to core; free from puckers, ripples, wrinkles, or sags.

C. Facing Material: Apply fabric facing fully covering visible surfaces of unit; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.

D. Dimensional Tolerances of Finished Units: Plus, or minus 1/16 inch.

PART 3 - EXECUTION

3.1 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 for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

C. Align fabric pattern and grain with adjacent units.

3.2 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

**END OF SECTION 09 84 33**

# SECTION 09 91 13 – EXTERIOR PAINTING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the exterior substrates indicated in the Exterior Painting Schedule at the end of this Section.
B. Related Sections include the following:
   1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
   2. Division 09 Section "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

### 1.3 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Samples for Verification: Labeled sample with stepped coats, for each type of paint system and each color and gloss of topcoat indicated.
C. Coating Maintenance Manual: Upon completion of the Project, the Contractor (or paint manufacturer/supplier) shall furnish a coating maintenance manual, equal to Sherman-Williams “Custodian Project Color and Product Information” report.
   1. The manual shall include an area summary with the finish schedule, area detail designating where each product/color/finish was used, product data pages., material safety data sheets, care and cleaning instructions, touchup procedures, and color samples of each color and finish used.]

### 1.4 QUALITY ASSURANCE

**A. The Contractor must ensure that manufacturer’s requirements are followed in preparation of substrates and application of new coatings. The contractor is to perform appropriate tests to verify that substrates are compatible with new coatings. This includes testing surfaces for whether the existing paint is oil-based or water-based.**
B. Single-Source Responsibility: For each painting system, use a single manufacturer for primer and topcoats.
C. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
D. Material Quality: Provide products of indicated quality or better for each coating type specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.
   1. Products: Proprietary names used to designate colors or materials are not intended to exclude equal or better products of other manufacturers. Equivalents products may submitted for approval by Architect through Product Requirements process indicated in Division 01, with executed CSI standard Substitution Request Form, complete with point-by-point comparison filled out for each proposed product compared with an MPI listed product. Proposed products must meet or exceed

the test results of the MPI listed product, including abrasion resistance, adhesion, corrosion weathering, salt fog resistance, dry heat resistance, and other requirements of this Section.

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F .
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

## 1.6 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide indicated products from the following, or comparable products approved by Design Builder:
   1. **Basis of Design**: The Sherwin-Williams Company (S-W).
   2. Benjamin Moore and Co. (Moore).
   3. PPG Paints (Pittsburgh).

## 2.2 PAINT, GENERAL

A. Material Compatibility:
   1. Provide materials for use within each paint system that are 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, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
B. Colors: To match existing, unless noted otherwise.

## 2.3 EXTERIOR LATEX PAINTS

A. Acrylic Latex: 100 percent acrylic satin-finish exterior latex for use over primed, fiber-cement siding.
   1. S-W: A-100 Exterior Latex Satin, A82 Series
   2. Moore: Moorgard Low Lustre Acrylic, 103
   3. PPG: SPEEDHIDE® Exterior Latex
B. Latex: semi-gloss exterior latex house paint for use over wood:
   1. S-W: A-100 Exterior Latex Gloss, A8 Series
   2. Moore: MoorGlo Soft Gloss, N096 01
   3. PPG: SPEEDHIDE® Exterior Latex
C. Acrylic: direct-to-metal waterborne acrylic gloss or semi-gloss enamel for use over structural steel and shop primed steel:

1. S-W: Pro-Industrial DTM Acrylic Semi-Gloss, B66-1150 Series
2. Moore: Impervex Enamel #309.
3. PPG: PITT-TECH PLUS
4. P & L: Z/F 2900 Series Enducryl Acrylic Maintenance Enamel.

## 2.4 METAL PRIMERS

A. Synthetic, Rust-Inhibiting Primer: Quick-drying, rust-inhibiting primer for priming ferrous metal (only) on exterior under alkyd enamel:
   1. S-W: Kem Kromik Universal Metal Primer B50W1.
   2. Moore: SuperSpec Alkyd Metal Primer, P06
   3. PPG: Multiprime 94-258

B. Waterborne Rust-Inhibiting Primer: NON-Ferrous Metal
   1. S-W: Pro Industrial Pro Cryl. Universal Metal Primer B66-1300
   2. Or manufacturer approved equal.

## 2.5 WOOD PRIMERS

A. Exterior Alkyd Wood Primer: Primer used to prime exterior wood trim:
   1. S-W: Exterior Oil-Based Wood Primer, Y24W8020.
   2. Moore: 176-00 Moorcraft Exterior Alkyd Primer.
   3. PPG: SEAL GRIP® Permanizer Plus® Exterior Wood Stabilizer

# 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 work.
B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
C. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
   1. Beginning coating application constitutes Contractor's acceptance of substrates 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 plates, machined surfaces, and similar items already in place that 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.
   2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

D. Apply field primer to unfinished shop primed surfaces.
E. Concrete Masonry Substrates: Remove 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. Masonry must be cured a minimum of 28 days.
F. Steel Substrates: If not shop prepared and primed, remove rust and loose mill scale. Clean using Power Tool Cleaning (SSPC-SP3) or other methods recommended in writing by paint manufacturer and approved by Design Builder.
G. Wood Substrates:
   1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
   2. Sand surfaces that will be exposed to view, and dust off.
   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 dried.

## 3.3 PREPARATION OF EXISTING SURFACES

**A. If existing surfaces are to be painted Contractor is to test existing coatings for compatibility and submit in writing the manufacturer's recommended primers and paint for compatibility.**
**B. Note paint coatings may change based on determination of existing substrate/coatings compatibility.**
C. Existing Concrete Masonry Units: Touch up all holes, dents, etc with manufacturer recommended patching components approved by the paint manufacturer for the intended purpose. Scrape all loose paint off. Properly sand for uniform CMU wall finish. Provide same number of finish coats.
D. Existing Ferrous Metals to Remain: Grind and sand all loose and peeling paint. Sand and feather all edges smooth. Prime bare metal before painting
E. Materials Preparation: Carefully mix and prepare paint materials according to manufacturer's directions.
   1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
   2. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.
   3. Use only thinners approved by the paint manufacturer and only within recommended limits.
F. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.
G. Upon manufacturer review of existing finish coat a manufacturer recommended primer will be determined prior to finish coating.

## 3.4 APPLICATION

A. Apply paints according to manufacturer's written instructions.
   1. Use applicators and techniques suited for paint and substrate indicated.
   2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR EXPOSED ACRYLIC COATING SCHEDULE

A. Steel Substrates: Purlins, girts, underside of steel decking, primed handrails and columns.
    a. Spot Prime Coat: Universal Rust Inhibitive Primer
    b. Intermediate Coat: Direct to Metal Acrylic Semi-Gloss
    c. Finish Coat: Direct to Metal Acrylic Semi-Gloss

    1. Applied Coating System for steel purlins, girts, & columns
        a. Acrylic primer, @ 2.0-4.0 mils DFT
    2. Field applied coating system for steel purlins, girts, & columns
        a. Direct to metal waterborne (Semigloss) @ 2.5-4.0 mils DFT

B. Metal Handrails, Hollow Metal Frames and Doors:
    1. Primer: Unless otherwise noted use manufacturer recommended primer.
    2. Intermediate Coat: Pro Industrial Waterbased Alkyd Urethane Semi-gloss B53-2150.
    3. Topcoat: Pro Industrial Waterbased Alkyd Urethane Semi-gloss B53-2150.

C. Exterior Wood Trim:
    1. Satin finish: Two finish coats over primer:
        a. Primer: Alkyd exterior wood primer.
        b. Intermediate Coat: Exterior Latex Satin house paint.
        c. Topcoat: Exterior Latex Satin house paint.

**END OF SECTION 09 91 13**

# SECTION 09 91 23 – INTERIOR PAINTING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following interior substrates:
   1. Concrete.
   2. Concrete Masonry Units Substrates:
   3. Steel.
   4. Galvanized metal.
   5. Wood.
   6. Gypsum board.

B. Related Sections include the following:
   1. Division 05 Sections for shop priming and finishing of metal substrates with primers specified in this Section.
   2. Division 06 Sections for shop priming carpentry with primers specified in this Section.
   3. Division 08 Sections for factory priming and finishing windows and doors not specified in this Section.
   4. Division 09 Section "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.

### 1.3 DEFINITIONS

A. MPI: Master Painters Institute. Product listings are available at www.paintinfo.com. MPI Architectural Painting Specification Manual is available at www.specifypaint.com.

B. Gloss Levels: As indicated in MPI Gloss Standards, measured at 60 degree angle. Where manufacturer's gloss descriptions differ from the MPI Gloss Standards, the MPI Gloss Standards shall govern.

C. MPI Gloss Standards

| Gloss Level | Description | Gloss At 60 Deg | Sheen At 85 Deg |
|---|---|---|---|
| G1 | A traditional matte finish - flat | Max. of 5 units | Max. of 10 units |
| G2 | A high side sheen flat - "a velvetlike" finish | Max. of 10 units | 10 - 35 units |
| G3 | A traditional "eggshell-like" finish | 10 - 25 units | 10 - 35 units |
| G4 | A "satinlike" finish | 20 - 35 units | Min. of 35 units |
| G5 | A traditional semigloss | 35 - 70 units | - |
| G6 | A traditional gloss | 70 - 85 units | - |
| G7 | A high gloss | More than 85 units | - |

1.4 SUBMITTALS

A. Designer of Record Approval is required for submittals with a "DA" designation; submittals not having a "DA" designation are for Contractor Quality Control approval. All submittals after DA or Contractor Quality Control approval shall be sent to the Government as For Information Only. Submit in accordance with Division 01 Section "Submittal Procedures".
B. Product Data: For each type of product indicated.
C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.
   1. Submit Samples on rigid backing, 8 inches square.
   2. Step coats on Samples to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.
D. Product List: For each product indicated, include the following:
   1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
   2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
      a. In lieu of MPI Approved Product List, comparable products may be submitted with request for substitution in accordance with Division 01 Section "Product Requirements", and manufacturer's certification of location of manufacturing and origin of products, as indicated below under "Quality Assurance" Article.
E. Coating Maintenance Manual: Upon completion of the Project, the Contractor (or paint manufacturer/supplier) shall furnish a coating maintenance manual, equal to Sherman-Williams “Custodian Project Color and Product Information” report.
   1. The manual shall included an area summary with the finish schedule, area detail designating where each product/color/finish was used, product data pages., material safety data sheets, care and cleaning instructions, touchup procedures, and color samples of each color and finish used.

1.5 QUALITY ASSURANCE

**A.** The **Contractor must ensure that manufacturer’s requirements are followed in preparation of substrates and application of new coatings. The contractor is to perform appropriate tests to verify that substrates are compatible with new coatings. This includes testing surfaces for whether the existing paint is oil-based or water-based.**
B. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.
C. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
      a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft.
      b. Other Items: Architect will designate items or areas required.
   2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
   3. Final approval of color selections will be based on benchmark samples.
      a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
   1. Maintain containers in clean condition, free of foreign materials and residue.

2. Remove rags and waste from storage areas daily.

1.7 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
   1. Quantity: Furnish an additional 2 percent, but not less than 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

A. Painting Schedule: Refer to end of Part 3 of this Section for listing of applications for each product.
B. Products, General: Refer to Part 2 for specific products. Subject to compliance with requirements, provide the Basis-of-Design products indicated or comparable products from one of the listed manufacturers for each substrate.
C. Colors: As indicated in Finish Schedule.
D. Material Compatibility:
   1. Provide materials for use within each paint system that are 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, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
E. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
   1. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
   2. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
   3. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
   4. Floor Coatings: VOC not more than 100 g/L.
   5. Sealers: waterproofing sealers 250 g/L limit; sanding sealers 275 g/L limit; all other sealers 200 g/L limit.
   6. Shellacs, Clear: VOC not more than 730 g/L.
   7. Shellacs, Pigmented: VOC not more than 550 g/L.
   8. Stains: 250 g/L limit.
   9. Flat Topcoat Paints: VOC content of not more than 50 g/L.
   10. Nonflat Topcoat Paints: VOC content of not more than 150 g/L.
   11. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
   12. Floor Coatings: VOC not more than 100 g/L.
   13. Sealers: waterproofing sealers 250 g/L limit; sanding sealers 275 g/L limit; all other sealers 200 g/L limit.
   14. Shellacs, Clear: VOC not more than 730 g/L.

15. Shellacs, Pigmented: VOC not more than 550 g/L.
16. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
17. Stains: 250 g/L limit.
18. Dry-Fog Coatings: VOC content of not more than 400 g/L.
19. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
20. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.

F. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
2. Restricted Components: Paints and coatings shall not contain any of the following:
a. Acrolein.
b. Acrylonitrile.
c. Antimony.
d. Benzene.
e. Butyl benzyl phthalate.
f. Cadmium.
g. Di (2-ethylhexyl) phthalate.
h. Di-n-butyl phthalate.
i. Di-n-octyl phthalate.
j. 1,2-dichlorobenzene.
k. Diethyl phthalate.
l. Dimethyl phthalate.
m. Ethylbenzene.
n. Formaldehyde.
o. Hexavalent chromium.
p. Isophorone.
q. Lead.
r. Mercury.
s. Methyl ethyl ketone.
t. Methyl isobutyl ketone.
u. Methylene chloride.
v. Naphthalene.
w. Toluene (methylbenzene).
x. 1,1,1-trichloroethane.
y. Vinyl chloride.

## 2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. **Basis of Design:** The Sherwin-Williams Company (S-W).
2. Benjamin Moore & Co.
3. PPG Architectural Finishes, Inc.

## 2.3 BLOCK FILLERS

A. Filler Coat Materials: Provide the manufacturer's recommended factory-formulated, latex-type concrete masonry block fillers that are compatible with the finish materials indicated.
B. Products: Subject to compliance with requirements, provide one of the following:
1. High-Performance Latex Block Filler:
Sherwin Williams Pro Industrial Heavy Duty Block Filler, B42W150 applied at a dry film thickness of not less than 10 to 14 mils or approved equal by BM, PPG or MAB.

2.4 PRIMERS/SEALERS

A. Concrete, Masonry, and Stucco (Alkali-Resistant Primer):
   1. Sherwin-Williams: Loxon Concrete & Masonry Primer, LX02W50.
   2. Benjamin Moore: Super Spec 100% Acrylic High Build Masonry Primer, N068
   3. PPG: PermaCrete Masonry Systems Interior/Exterior Alkali-Resistant Primer, 4-603xi.
B. Interior Latex Primer/Sealer:
   1. Sherwin-Williams: ProMar 200 Zero-VOC Interior Latex Primer, B28W2600
   2. Benjamin Moore; Fresh Start Natura Interior Latex Primer, 511
   3. PPG: Speedhide Zero Interior Latex Sealer, 6-4900
C. Interior latex-based wood primer
   1. Sherwin-Williams; Multi-Purpose Primer, B51-450
   2. Benjamin Moore Super Spec Undercoater, 253
   3. PPG; Seal Grip Int/Ext Stain Blocking Primer, 17-921xi

2.5 METAL PRIMERS

A. Alkyd Anticorrosive Metal Primer on Steel (only), NOT Galvanized Steel:
   1. Sherwin-Williams: Kem Kromik Universal Alkyd Primer, B50WZ1
   2. Benjamin Moore: Industrial, Alkyd Metal Primer, M06.
   3. PPG: MULTIPRIME | 94-258 SERIES
B. Rust-Inhibitive Primer (Water Based):
   1. Sherwin-Williams: Pro Indusrtial Pro-Cryl Universal Metal Primer, B66-1300
   2. Benjamin Moore; Acrylic Metal Primer, M04
   3. PPG: Pitt-Tech Plus Int/Ext DTM Primer, 90-912.
C. Galvanized-Metal Primer:
   1. Sherwin-Williams: Industrial & Marine DTM Acrylic Primer/Finish B66W1.
   2. Benjamin Moore; Acrylic Metal Primer, M04
   3. PPG: Pitt-Tech Plus Int/Ext DTM Primer, 90-912.
D. Quick-Drying Primer for Aluminum:
   1. Sherwin-Williams: Pro Indusrtial Pro-Cryl Universal Metal Primer, B66-1300
   2. Benjamin Moore; Acrylic Metal Primer, M04
   3. PPG: Pitt-Tech Plus Int/Ext DTM Primer, 90-912.
E. Waterborne Galvanized-Metal Primer:
   1. Sherwin-Williams: Industrial & Marine DTM Acrylic Primer/Finish B66W1.
   2. Benjamin Moore; Acrylic Metal Primer, M04
   3. PPG: Pitt-Tech Plus Int/Ext DTM Primer, 90-912.

2.6 WOOD PRIMERS

A. Wood-Knot Sealer: White shellac or other sealer recommended in writing by manufacturer for this purpose and meeting VOC requirements.
B. Interior Stain Blocking Wood Primer:
   1. Sherwin-Williams: Synthetic Shellac Primer , B49W60.
   2. Benjamin Moore: Seal Lock Plus Primer/Sealer IL-6800
   3. PPG: SEAL GRIP® Interior/Exterior Synthetic Stain-Killing Primer 17-931
C. Interior Enamel Undercoat:
   1. Sherwin-Williams: Premium Wall & Wood Primer, B28W8111
   2. Benjamin Moore: Super Spec Alkyd Enamel Undercoater & Primer C245
   3. PPG: SPEEDLINE™ Premium White Lacquer Undercoat 77-9600

2.7 ALKYD PAINTS

A. Interior Alkyd, (Semigloss):
   1. Sherwin-Williams: ProMar 200, Alkyd Semi-Gloss, B34W251
   2. Benjamin Moore: Moorcraft, Super Spec Alkyd Semi-Gloss Enamel, C271
   3. PPG: SPEEDHIDE® Interior/Exterior WB Alkyd

2.8 LATEX PAINTS

A. Institutional Low-Odor/VOC Latex, (Flat):
   1. Sherwin-Williams; ProMar 200 Zero VOC Flat, B30W2600 Series
   2. Benjamin Moore; Natura Flat, 512
   3. PPG; Speedhide Zero Interior Latex Flat, 6-4110XI
B. Institutional Low-Odor/VOC Latex, (Eggshell):
   1. Sherwin-Williams; ProMar 200 Eggshell B20W12600 Series
   2. Benjamin Moore; Natura Eggshell, 513 01
   3. PPG; Speedhide Zero Interior Latex Eggshell, 6-4310XI
C. Institutional Low-Odor/VOC Latex, (Semigloss):
   1. Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Semi-Gloss, B31W2600 Series
   2. Benjamin Moore; Natura Semi-Gloss, 514
   3. PPG; Speedhide Zero Interior Latex Semi-Gloss
D. Interior Latex Microbicidal (Eggshell):
   1. Sherwin-Williams: Superpaint with Sanitizing Technology, A87W00001
E. Interior Pre-Catalyzed Epoxy, (Semi-gloss):
   1. Sherwin-Williams: Pro Industrial Pre-Catalyzed Epoxy Semi-Gloss, K46-2150 Series
   2. Benjamin Moore:Pre Catalyzed Epoxy Semi-Gloss, V341.
   3. PPG: Pitt-Glaze WB1 Pre-Catalyzed Epoxy Semi-Gloss, 16-510
F. Interior Pre-Catalyzed Epoxy, (Eggshell):
   1. Sherwin-Williams: Pro Industrial Pre-Catalyzed Epoxy Eggshell, K45-2150 Series
   2. Benjamin Moore:Pre Catalyzed Epoxy Eggshell, V342.
   3. PPG: Pitt-Glaze WB1 Pre-Catalyzed Epoxy Eggshell, 16-310
G. Interior Waterborne Dryfall, (Flat):
   1. Sherwin-Williams: Pro Industrial Waterborne Acrylic Dryfall Flat, B42 Series
   2. Benjamin Moore: Latex Dryfall Flat, 395
   3. PPG: Super Tech WB Dry Fall Flat, 6-725XI
H. Interior Waterbase Alkyd Semi-Gloss by Sherwin Williams or approved equal.

2.9 FLOOR COATINGS:

A. Interior/Exterior Clear Concrete Floor Sealer (Water Based):
   1. Sherwin-Williams: H & C Clarishield Waterbased Wet Look Sealer
   2. Or approved equal.

2.10 MISCELLANEOUS WOOD-FINISHING MATERIALS

A. Wood-Finishing Materials: Provide the manufacturer's recommended factory-formulated, wood-finishing materials that are compatible with the substrate and undercoats indicated.
B. Products: Subject to compliance with requirements, provide one of the following:
   1. Oil-Type Interior Wood Stain: Slow-penetrating, oil-type wood stain.
      a. Sherwin-Williams - Minwax Performance Series Tintable Wood Stain
      b. Glidden – “ICI” 1700-XXX Woodpride interior solventborne wood finishing stain.
      c. Approved equal by BM, MAB, PPG.
   2. Interior Polyurethane clear satin varnish.

a. Sherwin-Williams - Minwax Fast Drying Polyurethane for Floors.
b. Glidden - “ICI” 1902-0000 Woodpride interior satin polyurethane varnish
c. Approved Equal BM, MAB, PPG.

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 work.
B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Concrete: 12 percent.
   2. Wood: 15 percent.
   3. Gypsum Board: 12 percent.
C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
   1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
B. Remove plates, machined surfaces, and similar items already in place that 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.
   2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
D. Apply field primer to unfinished shop primed surfaces.
E. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.
F. Steel Preparation for Shop Prime and Finish, and for Field Touch-up where damaged: Remove rust and protect damaged areas using methods recommended in writing by coating manufacturer.
   1. Prepared to comply with SSPC-SP 7 Brush-Off Blast Cleaning for all metal areas that are rusted, abraded, bare, or otherwise damaged.
G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
   1. Galvanized-metal substrates should not be chromate passivated (commercially known as "bonderized") if primers are field applied. If galvanized metal is chromate passivated, consult manufacturers for appropriate primers.
H. Aluminum Substrates: Remove surface oxidation.
I. Wood Substrates:
   1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
   2. Sand surfaces that will be exposed to view, and dust off.
   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 dried.

J. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

## 3.3 PREPARATION OF EXISTING SURFACES

**A. If existing surfaces are to be painted Contractor is to test existing coatings for compatibility and submit in writing the manufacturer's recommended primers and paint for compatibility.**

**B. Note paint coatings may change based on determination of existing substrate/coatings compatibility.**

C. Existing Concrete Masonry Units: Touch up all holes, dents, etc with manufacturer recommended patching components approved by the paint manufacturer for the intended purpose. Scrape all loose paint off. Properly sand for uniform CMU wall finish. Provide same number of finish coats.

D. Existing Ferrous Metals to Remain: Grind and sand all loose and peeling paint. Sand and feather all edges smooth. Prime bare metal before painting

E. Materials Preparation: Carefully mix and prepare paint materials according to manufacturer's directions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.
3. Use only thinners approved by the paint manufacturer and only within recommended limits.

F. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

G. Upon manufacturer review of existing finish coat a manufacturer recommended primer will be determined prior to finish coating.

## 3.4 APPLICATION

A. Apply paints according to manufacturer's written instructions.
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.

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. Apply primers and finish coats in accordance with manufacturer's recommended dry-film thickness, square foot per gallon, and mil thickness per coat. Do not add solvent or thinner to paint and coating products.

F. Allow adequate curing time before handling and before applying subsequent coats. Low VOC and water-based paint systems require longer drying times. Comply with MPI standards and manufacturer's written instructions. Protect in accordance with "Cleaning and Protection" Article below.

G. Painting Mechanical and Electrical Work: Paint same color as the adjoining substrate items exposed in equipment rooms and occupied spaces including, but not limited to, the following:
2. Mechanical Work:

a. Uninsulated metal piping.
b. Uninsulated plastic piping.
c. Pipe hangers and supports.
d. Tanks that do not have factory-applied final finishes. Should be prefinished.
e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

3. Electrical Work:
   a. Switchgear.
   b. Panelboards.
   c. Electrical equipment that is indicated to have a factory-primed finish for field painting.

## 3.5 FIRE RATED ASSEMBLIES

A. Permanently identify corridor partitions, smokestop partitions, horizontal exit partitions, exit enclosures and fire walls. Above decorative ceiling line and in concealed spaces, on both sides of wall, apply a minimum one-inch wide red line interrupted at maximum 12-ft spacing with the wording "X HOUR FIRE AND SMOKE BARRIER - PROTECT ALL OPENINGS" in 4-inch high letters with "X" designating the appropriate hourly rating.

## 3.6 FIELD QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:
   1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
   2. Testing agency will perform tests for compliance with product requirements.
   3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

## 3.7 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.8 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Horizontal Surfaces:
   1. Water-Based Clear Sealer System:
      a. First Coat: Interior/exterior clear concrete floor sealer (water based).
      b. Topcoat: Interior/exterior clear concrete floor sealer (water based).

B. Concrete Substrates, Vertical Surfaces:
   1. Latex System over bonding primer:
      a. Prime Coat: Primer, bonding, solvent based
      b. Intermediate Coat: Latex, interior, matching topcoat.
      c. Topcoat: Institutional Low-Odor/VOC Latex Semi-Gloss

C. Concrete Masonry Units Substrates:
   1. Latex Over Block Filler System: .
      a. 1st Coat Block Filler: Latex Block Filler
      b. 2nd Coat Block Filler: Latex Block Filler
      c. Intermediate Coat: Latex, matching top coat.
      d. Topcoat: Institutional Low-Odor/VOC Latex Semi-Gloss or Eggshell

D. Concrete Masonry Units Substrates: Substrates, High Use locations:
   1. Refer to Special Coatings.

E. Steel Substrates:
   1. Water-Borne, Alkyd:
      a. Prime Coat: Rust-inhibitive primer (water based)
      b. Intermediate Coat: B53-2150 Series, (Semi-Gloss)
      c. Topcoat: B53-2150 Series, (Semi-Gloss)

F. Galvanized-Metal Substrates:
   1. Institutional Low-Odor/VOC Latex System:
      a. Prime Coat: Waterborne galvanized-metal primer.
      b. Intermediate Coat: B53-2150 Series, (Semi-Gloss)
      c. Topcoat: B53-2150 Series, (Semi-Gloss)

G. Aluminum (Not Anodized or Otherwise Coated) Substrates:
   1. Institutional Low-Odor/VOC Latex System:
      a. Prime Coat: Quick-drying primer for aluminum,
      b. Intermediate Coat: B53-2150 Series, (Semi-Gloss)
      c. Topcoat: B53-2150 Series, (Semi-gloss)
   2. Latex System:
      a. Prime Coat: Quick-drying primer for aluminum,
      b. Intermediate Coat: Interior latex matching topcoat.
      c. Topcoat: B53-2150 Series, (Semi-Gloss)

H. Gypsum Board Substrates:
   1. Institutional Low-Odor/VOC Latex System:
      a. Prime Coat: Interior latex primer/sealer.
      b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
      c. Topcoat for ceilings: Interior latex (flat),
      d. Topcoat for Walls: Institutional low-odor/VOC interior latex (Eggshell)

I. Gypsum Board Substrates, High Use locations: Refer to Special Coatings.
   1. Refer to Special Coatings.

J. Ceiling deck, bar joist & misc. metal
   1. Waterborne Acrylic Dryfall
      a. Spot Prime bare or rusted metal: Rust-inhibitive primer (water based)
      b. Topcoat coat: Interior Waterborne Dryfall, (Flat) applied to full opacity
   2. Ceilings and Soffits - Latex System:.
      a. Prime Coat: Interior latex primer/sealer,
      b. Intermediate Coat: Interior latex matching topcoat.

c. Topcoat: Interior latex (flat),

3. Walls, unless noted otherwise - Latex System:
   a. Prime Coat: Interior latex primer/sealer,
   b. Intermediate Coat: Interior latex matching topcoat.
   c. Topcoat: Interior latex (Eggshell),
4. Walls, where indicated – Interior Mildew-Resistant System:
   a. Prime Coat: Interior latex primer/sealer.
   b. Intermediate Coat: Interior latex matching topcoat.
   c. Topcoat: Refer to Special Coatings.

**END OF SECTION 09 91 23**

# SECTION 09 97 00 - SPECIAL COATINGS

## 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 applying special coating systems to items and surfaces scheduled, including surface preparation, prime coats, and topcoats.
B. Types of special coating systems required for the Project include the following:
   1. Special coatings for interior use include the following:
      a. High-performance epoxy coating.
C. Related Sections: The following Sections contain requirements that relate to this Section:
   1. General painting is specified in Division 09 Section "Painting."

### 1.3 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division 01 Specification Sections.
B. Product data for each coating system specified, including block fillers and primers.
   1. Provide the manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each material proposed for use.
   2. List each material and cross-reference the specific coating, finish system, and application. Identify each material by the manufacturer's catalog number and general classification.
   3. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).
C. Samples for initial color selection in the form of manufacturer's color charts.
   1. After color selection, the Architect will furnish color chips for surfaces to be coated.
D. Samples for Verification Purposes: Provide samples of each color and material to be applied with texture to simulate actual conditions on representative samples of the actual substrate.
   1. Provide stepped samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until the required sheen, color, and texture are achieved.
   2. Provide a list of material and application for each coat of each sample. Label each sample as to location and application.
   3. Submit samples on the following substrates for the Architect's review of color and texture only.
      a. Concrete Masonry: Provide two 8-inch-square samples of masonry, with mortar joint in the center, for each finish and color.
      b. Gypsum Drywall: Provide two 12-inch-square samples of each color and material on drywall.

1.4 QUALITY ASSURANCE

**A.** The **Contractor must ensure that manufacturer's requirements are followed in preparation of substrates and application of new coatings. The contractor is to perform appropriate tests to verify that substrates are compatible with new coatings. This includes testing surfaces for whether the existing paint is oil-based or water-based.**

B. Applicator Qualifications: Engage an experienced applicator who has successfully completed coating system applications similar in material and extent to those indicated for the Project.

C. Single-Source Responsibility: Provide primers and undercoat material produced by the same manufacturer as the finish coats for each type of coating. Use only thinners recommended by the manufacturer and only within recommended limits.

D. Field Samples: On wall surfaces and other interior and exterior components, duplicate finishes of prepared samples. Provide full-coat finish samples on at least 100 sq. ft. of surface until the required sheen, color, and texture are obtained; simulate finished lighting conditions for reviewing in-place work.
   1. Final acceptance of colors will be from job-applied samples.
   2. The Architect will select one room, area, or surface to represent surfaces and conditions for each type of coating and substrate to be coated. Apply coatings in this room, area, or surface according to the schedule, or as specified. After finishes are accepted, this room, area or surface will be used for evaluation of coating systems of a similar nature.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the job site in the manufacturer's original, new, unopened packages, and containers bearing manufacturer's name and label, and the following information:
   1. Name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer's name, stock number and date of manufacture.
   4. Contents by volume, for major pigment and vehicle constituents.
   5. Thinning instructions.
   6. Application instructions.
   7. Color name and number.
   8. Handling instructions and precautions.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.
   1. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and applying the coatings.

1.6 PROJECT CONDITIONS

A. Apply coatings only when the temperature of surfaces to be coated and surrounding air temperatures are between 45 deg F (7 deg C) and 95 deg F (35 deg C).

B. Do not apply coatings in snow, rain, fog, or mist; when the 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.
   1. Allow wet surfaces to dry thoroughly and attain the temperature and conditions specified before proceeding with or continuing the coating operation.
   2. Work may continue during inclement weather only if areas and surfaces to be coated are enclosed and the temperature within the area can be maintained within limits specified by the manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
   1. High-performance epoxy coating.
      a. **Basis of Design:** Sherwin-Williams Company (S-W).
      b. Benjamin Moore & Co. (BM).
      c. Glidden-"ICI" Paint Stores, Inc. (ICI).
      d. M. A. Bruder & Sons, Inc. (MAB).
      e. PPG Industries, Inc. (PPG).

B. Products by other manufacturers must be submitted to the Architect for approval ten (10) days prior to the date of the bid opening. To be considered for approval, products must meet the specifications herein and be acceptable to the Architect and Owner. Products to be approved for use in this project must have PREBID WRITTEN APPROVAL from the Architect. Such approval will only be issued in the form of an Addendum, listing all approved equals. Any other commitments, verbal or otherwise, will not be honored.

2.2 SPECIAL COATING MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, finish coat material, and related materials that are compatible with one another and the substrates indicated under conditions of service and application as demonstrated by the manufacturer based on testing and field experience.

B. Material Quality: Provide the highest grade of the various coatings as regularly manufactured by acceptable coating manufacturers. Materials not displaying manufacturer's identification as a best-grade product will not be acceptable.
   1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials are not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish the manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: Provide color selections made by the Architect from the manufacturer's full range of standard colors.

2.3 MASONRY-BLOCK FILLERS

A. Masonry Block Fillers: Provide the manufacturer's recommended factory-formulated concrete masonry block fillers that are compatible with the finish materials indicated.

B. Available Products: Subject to compliance with requirements, block fillers that may be incorporated in the Work include:
   1. SW- B42W150 Interior/Exterior Heavy Duty Acrylic Block Filler
   2. Approved equal by BM, PPG, MAB.

2.4 PRIMERS AND SEALERS

A. Primer/Sealers: Provide the manufacturer's recommended factory-formulated primer/sealers that are compatible with the substrate and finish materials indicated.

B. Available Products: Subject to compliance with requirements, primer/sealers that may be incorporated in the Work include, but are not limited to:
   1. SW-Waterbone Catalyzed Epoxy B73W311 or approved equal by BM, MAB, PPG, SW.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions under which coatings will be applied for compliance with requirements on applying coatings. Surfaces to receive coatings must be thoroughly dry before coatings are applied.
   1. Do not proceed with coating application until unsatisfactory conditions have been corrected.
   2. Start of application will be construed as the Applicator's acceptance of surfaces within that particular area.

B. Coordinating Work: Review sections in which other coatings are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on the characteristics of specified finish materials to ensure compatible primers.
   1. Notify the Architect of problems anticipated using the coatings specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already in place that are not to be coated, or provide surface-applied protection prior to surface preparation and coating. Remove these items, if necessary, to completely coat the items and adjacent surfaces. Following the coating operations in each space or area, have removed items reinstalled by workers skilled in the trades involved.

B. Cleaning: Before applying coatings or other surface treatments, clean the substrates of substances that could impair bond of the various coatings. Remove oil and grease prior to cleaning. Schedule cleaning and coating application so dust and other contaminates from the cleaning process will not fall on wet, newly coated surfaces.

3.3 PREPARATION OF EXISTING SURFACES

**A. If existing surfaces are to be painted Contractor is to test existing coatings for compatibility and submit in writing the manufacturer’s recommended primers and paint for compatibility.**

**B. Note paint coatings may change based on determination of existing substrate/coatings compatibility.**

C. Existing Concrete Masonry Units: Touch up all holes, dents, etc with manufacturer recommended patching components approved by the paint manufacturer for the intended purpose. Scrape all loose paint off. Properly sand for uniform CMU wall finish. Provide same number of finish coats.

D. Existing Ferrous Metals to Remain: Grind and sand all loose and peeling paint. Sand and feather all edges smooth. Prime bare metal before painting

E. Materials Preparation: Carefully mix and prepare paint materials according to manufacturer's directions.
   1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
   2. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.
   3. Use only thinners approved by the paint manufacturer and only within recommended limits.

F. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

G. Upon manufacturer review of existing finish coat a manufacturer recommended primer will be determined prior to finish coating.

## 3.4 SURFACE PREPARATION

A. Clean and prepare surfaces to be coated according to the manufacturer's instructions for each particular substrate condition and as specified.
   1. Provide barrier coats over incompatible primers, or remove and reprime. Notify the Architect in writing of problems anticipated when using the specified finish-coat material with substrates primed by others.
   2. Cementitious Surfaces: Prepare concrete, concrete masonry block, cement plaster, and similar surfaces to receive special coatings. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen, as required, to remove glaze. If hardeners or sealers have been used to improve concrete curing, use mechanical methods to prepare surface.
      a. Use abrasive blast-cleaning methods if recommended by the coating system manufacturer.
      b. Determine alkalinity and moisture content of surfaces to be coated by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish coats to blister and burn, correct this condition before application. Do not apply coatings over surfaces where the moisture content exceeds that permitted in the manufacturer's printed directions.

B. Material Preparation: Carefully mix and prepare materials according to the coating manufacturer's directions.
   1. Maintain containers used in mixing and application of coatings according to the manufacturer's directions.
   2. Stir materials before applying to produce a mixture of uniform density; stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain the coating material before using.
   3. Use only the type of thinners approved by the manufacturer and only within recommended limits.

C. Tinting: Tint each undercoat a lighter shade to facilitate identifying each coat where multiple coats of the same material are to be applied. Tint undercoats to match the color of the finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

## 3.5 APPLICATION

A. General: Apply special coatings by brush, roller, spray, squeegee, or other applicators according to the manufacturer's directions. Use brushes best suited for the material being applied. Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
   1. Do not apply coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
   2. Coating colors, surface treatments, and finishes are indicated in the Schedules.
   3. Provide finish coats compatible with the primers used.
   4. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Where sanding is required, according to the manufacturer's directions, sand between applications to produce a smooth, even surface.
   5. When undercoats or other conditions show through the final coat, apply additional coats until the cured film has a uniform coating finish, color, and appearance. Give special attention to edges, corners, crevices, welds, exposed fasteners, and similar surfaces to ensure that they receive a dry film thickness equivalent to that of flat surfaces.
   6. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
      a. Coat surfaces behind movable equipment and furniture the same as similar exposed surfaces.
      b. Coat the back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

c. Omit primer on metal surfaces that have been shop-primed and touch-up painted.

B. Scheduling Coating: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for coating as soon as practicable after preparation and before subsequent surface deterioration.
   1. Allow sufficient drying time between successive coats. Do not recoat until the coating has dried so it feels firm and does not deform or feel sticky under moderate thumb pressure and where applying another coat does not cause the undercoat to lift or lose adhesion.

C. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to the manufacturer's directions.
   1. Brushes: Use brushes best suited for the material applied.
   2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
   3. Spray Equipment: Use spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

D. Minimum Coating Thickness: Apply each material no thinner than the manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by the manufacturer.

E. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

F. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to the material required to be coated or finished that has not been prime-coated by others.
   1. Recoat primed and sealed substrates where there is evidence of suction spots or unsealed areas in the first coat to ensure a finish coat with no burn-through or other defects caused by insufficient sealing.

G. Brush Application: Brush-out and work brush coats into surfaces in an even film. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.
   1. Apply primers and first coats by brush unless the manufacturer's instructions permit using mechanical applicators.

H. Mechanical Applications: Use mechanical methods to apply coating when permitted by the manufacturer's recommendations and governing regulations.
   1. Wherever using spray application, apply each coat to provide the equivalent hiding of brush-applied coats. Do not double-back with spray equipment building-up film thickness of two coats in one pass, unless recommended by the manufacturer.

I. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish, or recoat work not complying with specified requirements.

## 3.6 FIELD QUALITY CONTROL

A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during coating operations.
   1. The Owner will engage the services of an independent testing agency to sample the coating being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in the presence of the Contractor.
   2. The testing agency will perform appropriate tests for the following characteristics as required by the Owner:
      a. Quantitative materials analysis.
      b. Absorption.
      c. Accelerated weathering.
      d. Accelerated yellowness.
      e. Color retention.
      f. Alkali and mildew resistance.
      g. Abrasion resistance.
      h. Apparent reflectivity.
      i. Washability.

j. Dry Opacity.
k. Recoating.
l. Skinning.

3. If results show materials being used do not comply with requirements, the Contractor may be directed to stop work and remove noncomplying materials, pay for testing, recoat surfaces coated with rejected materials, or remove rejected materials from previously coated surfaces if, upon recoating with specified materials, the two coatings are not compatible.

## 3.7 CLEANING

A. At the end of each work day, remove rubbish, empty cans, rags, and other discarded materials from the site. After completing work, clean glass and spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

## 3.8 PROTECTION

A. Protect work of other trades, whether being coated or not, against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as acceptable to the Architect. Leave in an undamaged condition.
   1. Provide "Wet Paint" signs to protect newly coated finishes. Remove temporary protective wrappings provided by others to protect their work after completing coating operations.
   2. At completion of other trades' construction activities, touch up and restore damaged or defaced coated surfaces.

## 3.9 SPECIAL COATING SCHEDULE

A. Provide the following coating systems for substrates indicated:
   1. Where undercoats or other conditions show through final coat, apply additional coats until the cured film is of uniform coating finish, color, and appearance.

B. Concrete Masonry Units:
   1. Coating System: Provide two finish coats concrete masonry block filler.
   2. Filler Coat: Concrete masonry block filler.
   3. First and Second Coats: Epoxy coating.

C. Gypsum Drywall:
   1. Primer: Pro Mar 200 Zero VOC Latex Primer B28W2600.
   2. First and Second Coats: High-performance epoxy coating.

D. PT-1A and PT-2A: Walls
   1. First and Second Coats: Sherwin Williams SW-Waterbone Catalyzed Epoxy B73W311 or equal by BM, PPG, MAB

E. PT-3A: Ceilings in Locker Rooms: 619 and 620 and Restrooms: 619A and 620A
   1. First and Second Coats: Sherwin Williams Macropoxy 646 Fast Cure Epoxy or equal by BM, PPG, MAB

**END OF SECTION 09 97 00**

# SECTION 10 11 00 - VISUAL DISPLAY SURFACES

## 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. Markerboards.
   2. Tackboards.
   3. Display rails.
   4. Support systems for visual display boards.

B. Related Sections include the following:
   1. Division 06 Section "Rough Carpentry" for wood blocking.

### 1.3 DEFINITIONS

A. Tackboard: Framed or unframed tackable surface.

B. Visual Display Boards: Chalkboards, markerboards, and tackboards.

### 1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Show location of panel joints.
   2. Include sections of typical trim members.

C. Samples for Initial Selection: For each type of visual display surface indicated and as follows:
   1. Actual sections of porcelain-enamel face sheet and visual display wall panel
   2. Fabric swatches of vinyl-fabric-faced tack assemblies.
   3. Samples of accessories involving color selection.
   4. Aluminum Trim and Accessories: Samples of each finish type and color, on 6-inch-long sections of extrusions and not less than 4-inch squares of sheet or plate, showing the full range of colors available.

D. Samples for Verification: For each type of visual display surface indicated and as follows:
   1. Visual Display Surface: Not less than 8-1/2 by 11 inches, mounted on substrate 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. Rail Support System: 6-inch- long sections.
   4. Accessories: Full-size Sample of each type of accessory.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for surface-burning characteristics of vinyl polyester fabrics.

F. Qualification Data: For Installer.

G. Maintenance Data: For visual display surfaces to include in maintenance manuals.

H. **Certificates:** In lieu of laboratory test reports, when permitted by the Architect, submit the manufacturer's certification that vinyl-fabric-faced cork tackboard materials furnished comply with requirements specified for flame spread ratings.
I. Warranties: Special warranties specified in this Section.

## 1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of motor-operated, sliding visual display unit manufacturer for installation and maintenance of units required for this Project.
B. Source Limitations: Obtain each type of visual display surface through one source from a single manufacturer.
C. Product Options: Drawings indicate size, profiles, and dimensional requirements of visual display surfaces and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
    1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
D. Fire-Test-Response Characteristics: Provide fabrics with the surface-burning characteristics indicated, as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
    1. Flame Spread: 25 or less.
    2. Smoke Developed: 10 or less.
E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-built visual display boards, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.
B. Store visual display units vertically with packing materials between each unit.

## 1.7 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.
    1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating visual display surfaces without field measurements. Coordinate wall construction to ensure that actual dimensions correspond to established dimensions.
    2. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

## 1.8 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Surfaces lose original writing and erasing qualities.
   b. Surfaces become slick or shiny.
   c. Surfaces exhibit crazing, cracking, or flaking.
2. Warranty Period: Life of the building.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 MATERIALS, GENERAL

A. Porcelain-Enamel Face Sheet: ASTM A 424, enameling-grade steel, uncoated thickness indicated; with exposed face and edges coated with primer, 1.7-to-2.5-mil- thick ground coat, and color cover coat; and concealed face coated with primer and 1.7-to-2.5-mil- thick ground coat.
   1. Coat the exposed face and exposed edges with a 3-coat process consisting of primer, ground coat, and color cover coat, and the concealed face with a 2-coat process consisting of primer and ground coat.
   2. Matte-Finish Cover Coat: Low reflective; chalk wipes clean with dry cloth or standard eraser. Minimum 2.0-to-2.5-mil- thick cover coat. Cover and ground coats shall be fused to steel at manufacturer's standard firing temperatures but not less than 1250 deg F.
      a. Product: PolyVision Corporation; $P^3$ ceramicsteel Chalkboard.
   3. Gloss-Finish Cover Coat: Gloss as indicated; dry-erase markers wipe clean with dry cloth or standard eraser. Minimum 3.0-to-4.0-mil- thick cover coat. Cover and ground coats shall be fused to steel at manufacturer's standard firing temperatures but not less than 1475 deg F.
      a. Product: PolyVision Corporation; $P^3$ ceramicsteel Markerboard.

B. Hardboard: AHA A135.4, tempered.

C. Particleboard: Manufacturer’s standard 3/8” thick particleboard core material complying with the requirements of ANSI A208.1, Grade 1-M-1.

D. Cork Sheet: MS MIL-C-15116-C, Type II.

E. Vinyl Fabric: FS CCC-W-408, Type II, burlap weave; weighing not less than 13 oz./sq. yd. laminated to ¼” thick cork sheet; with flame-spread index of 25 or less when tested according to ASTM E 84.
   1. Backing: Make panels rigid by factory laminating cork face sheet under pressure to 1/4-inch-thick hardboard backing.

F. Extruded Aluminum: ASTM B 221, Alloy 6063.

G. High-Pressure Plastic Laminate: NEMA LD 3.

### 2.3 MARKERBOARD ASSEMBLIES

A. Porcelain-Enamel Markerboard Assembly: Balanced, high-pressure, factory-laminated markerboard assembly of 3-ply construction consisting of backing sheet, core material, and 0.021-inch thick, porcelain-enamel face sheet with gloss finish.
   1. Manufacturers:
      a. AARCO Products, Inc.
      b. ADP/Lemco, Inc.
      c. Bangor Cork Company, Inc.

d. Best-Rite Manufacturing.
e. Claridge Products & Equipment, Inc.
f. Egan Visual Inc.
g. Ghent Manufacturing Inc.
h. Marsh Industries, Inc.
i. Platinum Visual Systems; a division of ABC School Equipment, Inc.
j. PolyVision Corporation.

2. Particleboard Core: 3/8 inch thick; with 0.015-inch- thick, aluminum sheet backing.
3. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.

## 2.4 TACK ASSEMBLIES

A. Manufacturers:
1. A-1 Visual Systems.
2. AARCO Products, Inc.
3. ADP/Lemco, Inc.
4. Bangor Cork Company, Inc.
5. Best-Rite Manufacturing.
6. Claridge Products & Equipment, Inc.
7. Egan Visual Inc.
8. Ghent Manufacturing Inc.
9. Marsh Industries, Inc.
10. Platinum Visual Systems; a division of ABC School Equipment, Inc.
11. PolyVision Corporation.

B. Vinyl-Fabric-Faced Tack Assembly: 1/4-inch thick, vinyl-fabric-faced cork sheet factory laminated to 1/4-inch thick hardboard backing.

## 2.5 VISUAL DISPLAY RAILS

A. Manufacturers:
1. Best-Rite Manufacturing.
2. Claridge Products & Equipment, Inc.
3. Ghent Manufacturing Inc.
4. Marsh Industries, Inc.
5. PolyVision Corporation.

B. General: Manufacturer's standard, tackable visual display surface fabricated into narrow rail shape and designed for displaying material.

## 2.6 RAIL SUPPORT SYSTEM FOR VISUAL DISPLAY BOARDS

A. Manufacturers:
1. Best-Rite Manufacturing.
2. Egan Visual Inc.
3. K.O.H. Design, Inc.
4. Peter Pepper Products, Inc.
5. PolyVision Corporation.

B. Support Rails: Horizontal, wall-mounted, extruded-aluminum rails designed to receive hanger clip and to support visual display boards; capable of gripping and suspending paper directly from rail.
1. Finish: Clear anodic.
2. Color: As selected by Architect from full range of industry colors and color densities.

C. Hanger Clips: Extruded aluminum with finish to match rails; designed to support independent visual display boards by engaging support rail and top trim of board.

D. Visual Display Panels: Fabricated from not less than 3/8-inch thick, kraft-paper honeycomb core; designed to be rigid and to resist warpage, and with aluminum trim designed to engage hanger clips.

## 2.7 GRIP STRIP WALL MOUNTED DISPLAY SYSTEM

A. Extruded aluminum rail sections with plastic capture rods to hold paper displays, located as indicated on the Drawings. Provide units for screw fastening to masonry walls, including appropriate fasteners.

## 2.8 MARKERBOARD AND TACKBOARD ACCESSORIES

A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch thick, extruded aluminum; of size and shape indicated.
   1. Field-Applied Trim: Manufacturer's standard snap-on trim with no visible screws or exposed joints.
   2. Factory-Applied Trim: Manufacturer's standard.

B. Marker tray: Manufacturer's standard, continuous.
   1. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.

C. Map Rail: Provide the following accessories:
   1. Display Rail: Continuous and integral with map rail; fabricated from cork approximately 1 to 2 inches wide.
   2. End Stops: Located at each end of map rail.
   3. Map Hooks: Two map hooks for every 48 inches of map rail or fraction thereof.
   4. Flag Holder: One for each room.
   5. Paper Holder: Extruded aluminum; designed to hold paper by clamping action.

## 2.9 FABRICATION

A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.

B. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to neat, hairline closure.
   1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

## 2.10 ALUMINUM FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

D. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

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.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
B. Examine walls and partitions for proper backing for visual display surfaces.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove dirt, scaling paint, projections, and depressions that will affect smooth, finished surfaces of visual display boards.
B. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, and substances that will impair bond between visual display boards and surfaces.
   1. Seal wall surfaces indicated to receive visual display fabric.

3.3 INSTALLATION, GENERAL

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.
   1. Mounting Height for Grades K through 3: 24 inches above finished floor to top of marker tray.
   2. Mounting Height for Grades 4 through 6: 28 inches above finished floor to top of marker tray.
   3. Mounting Height for Grades 7 and Higher: 36 inches above finished floor to top of marker tray.
B. Field-Assembled Visual Display Units: 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 acceptable to Architect.
   2. Provide manufacturer's standard vertical-joint spline system between abutting sections of chalkboards & markerboards.
   3. Provide manufacturer's standard mullion trim at joints between chalkboards, markerboards and tackboards of combination units.
   4. Where size of visual display boards 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.

3.4 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY UNITS

A. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches o.c. Secure both top and bottom of boards to walls.
   1. Field-Applied Aluminum Trim: Attach trim over edges of visual display boards and conceal grounds and clips. Attach trim to boards with fasteners at not more than 24 inches o.c.
      a. Attach marker trays to boards with fasteners at not more than 12 inches o.c.
B. Display Rails: Install rails in locations and at mounting heights indicated on Drawings, or if not indicated, at height indicated below. Attach to wall surface with fasteners at not more than 16 inches o.c.
   1. Mounting Height: **60 inches** above finished floor to top of rail.

3.5 INSTALLATION OF RAIL SUPPORT SYSTEM

A. Rail Support System: Install horizontal support rail in locations and at mounting heights indicated on Drawings, or if not indicated, at height indicated below. Attach to wall surface with fasteners at 12 inches o.c.
   1. Mounting Height: **72 inches** above finished floor to top of rail.
   2. Hang visual display units on rail support system.

3.6 CLEANING AND PROTECTION

A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.
B. Touch up factory-applied finishes to restore damaged or soiled areas.
C. Cover and protect visual display surfaces after installation and cleaning.

3.7 VISUAL DISPLAY SURFACE SCHEDULE

A. Visual Display Board: Factory assembled.
   1. Markerboard: Porcelain-enamel markerboard assembly.
      a. Color: As selected by Architect from full range of industry colors.
   2. Factory-Applied Aluminum Trim: with clear anodic finish.
      a. Color: As selected by Architect from full range of industry colors and color densities.
   3. Accessories:
      a. Marker tray: Box type.
      b. Map rail with display rail, end stops, map hooks, and flag holder.
   4. Width: As indicated on Drawings.
   5. Height: As indicated on Drawings.
   6. Mounting: Wall.
   7. Mounting Height: As indicated on Drawings.
B. Tackboard: Factory assembled.
   1. Tack Surface: Vinyl-fabric-faced tack assembly.
   2. Edges: Concealed by trim.
      a. Factory-Applied Aluminum Trim: with clear anodic finish.
         1) Color: As selected by Architect from full range of industry colors and color densities.
   3. Width: As indicated on Drawings.
   4. Height: As indicated on Drawings.
   5. Mounting: Wall.
   6. Mounting Height: As indicated on Drawings.
C. Visual Display Rail: Factory assembled.
   1. Tack Surface: Vinyl-fabric-faced tack assembly.
   2. Edges: Extruded-aluminum trim.
   3. Ends: Aluminum.
   4. Size: 1 inch high by length indicated.

**END OF SECTION 10 11 00**

# SECTION 10 14 00 – SIGNAGE

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:
   1. Panel signs.
   2. Fire Extinguisher Signs
   3. Dimensional Letters
B. Related Sections include the following:
   1. Division 01 Section "Allowances" for additional information concerning Signage Allowance.
      a. General Contractor shall include in his Base Bid an allowance for specialty signs as indicated in Division 01.
      b. The information provided in this section concerning interior signage is intended to assist the Contractor in determining his labor and installation costs.

### 1.2 DEFINITIONS

A. ADAAGBA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities" (ADAAG); Architectural Barriers Act (ABA) Accessibility Guidelines", and ANSI ICC A117.1-2009.

### 1.3 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Shop Drawings: Show fabrication and installation details for signs.
   1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
   2. Provide message list, type styles, graphic elements**,** including tactile characters and Braille, and layout for each sign.
C. Samples: For each sign type and for each color and texture required.

### 1.4 SHOP DRAWINGS

A. Provide shop drawings for approval prior to fabrication of any signs. Shop drawings shall be approved by the Architect prior to fabrication.
B. The information provided in this section concerning interior signage is intended to assist the Contractor in determining his labor and installation costs.

### 1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with applicable provisions in the North Carolina Building Code Chapter 2012 Chapter 11, ICC A117.1-2009 and ADAAG ADA Accessibility Guidelines.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cast Acrylic Sheet: Provide cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet, in sizes and thicknesses indicated or required. Molded, seamless, thermosetting panels with a minimum tensile strength of 15,000 psi when tested according to ASTM D 638 and with a minimum flexural strength of 30,000 psi when tested according to ASTM D 790. Provide a minimum allowable continuous service temperature of 176 degrees F and of colored opaque acrylic sheets in color and finishes indicated, or if not indicated, as selected from manufacturer's standards

2.2 MATERIALS

A. Panel Signs
   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. ACE Sign Systems, Inc.
      b. Advance Corporation; Braille-Tac Division.
      c. Allen Industries Architectural Signage
      d. Allenite Signs; Allen Marking Products, Inc.
      e. APCO Graphics, Inc.
      f. ASI-Modulex, Inc.
      g. Best Sign Systems Inc.
      h. Bunting Graphics, Inc.
      i. Corum Signs, Inc.
      j. Fossil Industries, Inc.
      k. Gemini Incorporated.
      l. Grimco, Inc.
      m. Innerface Sign Systems, Inc.
      n. InPro Corporation
      o. Matthews International Corporation; Bronze Division.
      p. Mills Manufacturing Company.
      q. Mohawk Sign Systems.
      r. Nelson-Harkins Industries.
      s. Seton Identification Products.
      t. Signature Signs, Incorporated.
      u. Supersine Company (The)
B. Panel Signs: Provide (1) per each room including (1) mounted on the exterior of the building at locations noted.
   1. Plastic Panel Insert:
      a. Laminated, Polycarbonate Faced Sheet: 0.060-inch- thick, polycarbonate face sheet laminated to each side of 0.394-inch- thick phenolic backing.
      b. Size: 8 inches by 6 inches.
      c. Edge Condition: Square cut.
      d. Corner Condition: Square.
      e. Mounting: Mounted with two faced tape except where the substrate or exterior conditions require mechanical fasteners.
      f. Color: As selected by Architect from manufacturer's full range.
      g. Copy: To be provided by the Owner.
      h. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch above surface with contrasting colors.
C. Fire Extinguisher Signs: Provide (1) per each fire extinguisher.
   1. Plastic Panel Insert:

a. Laminated, Polycarbonate Faced Sheet: 0.060-inch- thick, polycarbonate face sheet laminated to each side of 0.394-inch- thick phenolic backing.
b. Size: 3 inches by 12 inches.
c. Edge Condition: Square cut.
d. Corner Condition: Square.
e. Mounting: Mounted with two faced tape except where the substrate or exterior conditions require mechanical fasteners.
f. Color: As selected by Architect from manufacturer's full range.
g. Copy: To be provided by the Owner.

D. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch above surface with contrasting colors.

E. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADAAG Accessibility Guidelines. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.

## 2.3 DIMENSIONAL LETTERS

A. Letter Material: Aluminum in Satin finish
B. Fabricated Letters: Provide size and style as indicated in the drawings
1. Thickness: As indicated.
2. Height: As indicated on drawings and scheduled below.
C. Mounting Method: Mechanically attached back.
D. Fabrication:
1. Cast metal letters are tapped for threaded stud insertion.
2. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.
3. Create signage to required sizes and layout. Comply with requirements indicated for design, dimensions, finish, color, and details of construction.

## 2.4 ACCESSORIES

A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

## 2.5 FABRICATION

A. General: Provide manufacturer's standard signs of configurations indicated.
1. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.
2. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.

2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
   1. Two-Face Tape: Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.Delete paragraph below if no bracket-mounted signs. Revise if custom-fabricated fittings are required and detailed. Insert other mounting method to suit Project.
   2. Silicone-Adhesive Mounting: Attach signs to irregular, porous, or vinyl-covered surfaces. Use liquid silicone adhesive recommended by the sign manufacturer to attach sign units. Use double-sided vinyl tape where recommended by sign manufacturer to hold the sign in place until the adhesive has fully cured. Provide a minimum double bead of adhesive to insure adhesion and to deter unauthorized removal.
      a. Use silicone adhesive mounting where panel signs are required to be applied directly to the wall or door surface, or where panel signs are to be permanently installed in panel sign frames.
   3. Signs Mounted on Glass: Provide matching opaque plate on opposite side of glass to conceal mounting materials.

C. Dimensional Characters: Mount characters using standard fastening methods to comply with manufacturer's written instructions for character form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish character spacing and to locate holes for fasteners.

D. Projected Mounting: Mount characters at projection distance from wall surface indicated. Revise if standard installation methods are not acceptable.

**END OF SECTION 10 14 00**

# SECTION 10 21 13 - TOILET COMPARTMENTS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes solid-polymer units as follows:
   1. Toilet Enclosures: Floor mounted toilet compartments.

B. Related Sections include the following:
Division 10 "Toilet and Bath Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories.

### 1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Show locations of cutouts for compartment-mounted toilet accessories.
   2. Show locations of reinforcements for compartment-mounted grab bars.

C. Samples for Initial Selection: For each type of unit indicated.

### 1.4 QUALITY ASSURANCE

A. Comply with requirements in CID-A-A-60003, "Partitions, Toilets, Complete."

### 1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication and indicate measurements on Shop Drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating toilet compartments without field measurements. Coordinate wall, floor, ceilings, and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

B. Coordination: Furnish inserts and anchorages which must be built into other work for installation of toilet partitions and related work; coordinate delivery with other work to avoid delay.

PART 2 - PRODUCTS

2.1 SOLID-POLYMER UNITS

A. Basis of Design: Scranton Products: Aria Toilet Partitions: Traditional 1000 Series or comparable product by one of the following:
1. Accurate Partitions Corporation.
2. Sanymetal; a Crane Plumbing Company.
3. General Partitions
4. Ampco

B. General: Provide materials which have been selected for surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are not acceptable.

C. Door, Panel, and Pilaster Construction: Full height, floor mounted, overhead braced, solid, high-density polyethylene (HDPE) panel material, not less than 1 inch thick, ¼" radiused edges. One edge of pilaster and transom panels to be shiplapped.
1. Color and Pattern: One color and pattern in each room as selected by Architect from manufacturer's full range of colors and patterns. Manufacturer must offer a complete range of colors, including solid colors without multi-colored flecks or chips.
2. Texture: Manufacturer must be capable of providing panels with a selection of textured finishes.

D. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; Stainless steel.

E. Brackets (Fittings):
1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

2.2 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
1. Material: Chrome-plated, nonferrous, cast zinc alloy (zamac), clear anodized aluminum or stainless steel.
2. Hinges: Helix style 78 inches edge mounted continuous hinge, stainless steel.
3. Occupancy Indicator Latch and Housing: Satin stainless-steel showing green and red occupancy indicators.

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 hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.3 FABRICATION

A. General: Furnish standard doors, panels, screens, and pilasters fabricated for partition system, unless otherwise indicated. Furnish units with cutouts, drilled holes, and internal reinforcement to receive partition-mounted hardware, accessories, and grab bars, as indicated.

B. Overhead-Braced Units: Provide stainless steel supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Doors: Unless otherwise indicated, provide 79-inch-high and 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 indicated to be accessible to people with disabilities.
1. Hinges: Manufacturer's standard self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees. Provide gravity type, spring-action cam type, or concealed torsion rod type. to suit manufacturer's standards.
2. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be accessible to people with disabilities.
3. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.
4. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
5. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with accessibility requirements of authorities having jurisdiction. Provide units on both sides of doors at compartments indicated to be accessible to people with disabilities.

## PART 3 - EXECUTION

### 3.1 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: 1/8 inch at top of door, no gap at vertical edge, zero sight.
   b. Panels and Walls: 1 inch at floor for door only, side panels sit on floor.
2. Angled / Channel Brackets: Secure panels to walls and to pilasters with continuous stainless steel angled and channel brackets, locate fasteners to correspond to spacings and locations to match those at wall anchorages. Secure panels in position with manufacturer's recommended anchoring devices.
   a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Secure continuous head rail to each pilaster with not less 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.

### 3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to 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.

B. Clean exposed surfaces of partition systems using materials and methods recommended by manufacturer, and provide protection as necessary to prevent damage during remainder of construction period.

**END OF SECTION 10 21 13**

# SECTION 10 28 00 – TOILET AND BATH ACCESSORIES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:
   1. Public-use washroom accessories
   2. Custodial accessories

### 1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:
   1. Construction details and dimensions.
   2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Material and finish descriptions.
   4. Features that will be included for Project.
   5. Manufacturer's warranty.

B. Setting drawings where cutouts are required in other work, including templates, substrate preparation instructions, and directions for preparing cutouts and installing anchorage devices.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated on Drawings.

D. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

### 1.4 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Inserts and Anchorages: Furnish accessory manufacturers' standard inserts and anchoring devices that must be set in concrete or built into masonry. Coordinate delivery with other work to avoid delay.

### 1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 15 years from date of Final Completion.
   2. 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 requirements of the Contract Documents
B. Warm- Air Dryers: Manufacturer's standard form in which manufacturer agrees to replace units that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 5 years from date of Final Completion.
   2. 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 requirements of the Contract Documents

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated.
B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch minimum nominal thickness.
C. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
D. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. A & J Washroom Accessories, Inc.
   2. American Specialties, Inc.
   3. Bobrick Washroom Equipment, Inc.
   4. Bradley Corporation.
   5. General Accessory Manufacturing Co. (GAMCO).
   6. McKinney/Parker
B. Toilet Accessories: As indicated on the drawings for basis of design, furnished by and installed by. Accessories included but not limited to the following:
   1. Toilet Tissue Dispenser: Furnished by Owner, Installed by Owner.
   2. Paper Towel Holders: Furnished by Owner and Installed by Owner.
   3. Waste Receptacle: Furnished by Owner and Installed by Owner.
   4. Liquid-Soap Dispenser: Furnished by Owner and Installed by Owner.
   5. Sanitary-Napkin Disposal Unit: Furnished by Owner and Installed by Owner.
   6. Grab Bar as indicated on the drawings: Furnished by Contractor and Installed by Contractor
      a. Mounting: Flanges with concealed fasteners.
      b. Material: Stainless steel, 0.05 inch thick.
      c. Finish: Smooth, No. 4, satin finish on ends and slip-resistant texture in grip area.

d. Outside Diameter: 1-1/2 inches.
e. Configuration and Length: As indicated on Drawings.

7. Mirror Unit as indicated on the drawings for basis of design: Furnished by Contractor and Installed by Contractor
8. Mirror Unit Hangers: Provide system for mounting mirror units that will permit rigid, tamperproof, and theftproof installation, as follows:
9. Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

## 2.3 UNDERLAVATORY GUARDS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
B. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
   1. Plumberex Specialty Products, Inc.
   2. TCI Products.
   3. Truebro, Inc.
C. Underlavatory Guard:
   1. Description: Insulating pipe covering for supply and drain piping assemblies, that prevent direct contact with and burns from piping, and allow service access without removing coverings.
   2. Material and Finish: Antimicrobial, molded-plastic, white.

## 2.4 CUSTODIAL ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. A & J Washroom Accessories, Inc.
   2. American Specialties, Inc.
   3. Bobrick Washroom Equipment, Inc.
   4. Bradley Corporation.
   5. General Accessory Manufacturing Co. (GAMCO).
B. Custodial Accessories as indicated on the drawings for basis of design.
   1. General Accessory Manufacturing Co. (GAMCO).
C. Mop and Broom Holder:
   a. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
   b. Length: 24 inches.
   c. Hooks: Three.
   d. Four, spring-loaded, rubber hat, cam type.
   e. Material and Finish: Stainless steel, No. 4 finish (satin).
   f. Rod: Approximately 1/4-inch- diameter stainless steel.

## 2.5 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.
C. General: Only a maximum 1-1/2-inch-diameter, unobtrusive stamped manufacturer logo, as approved by Architect, is permitted on exposed face of toilet or bath accessory units. On either interior surface not exposed to view or back surface, provide additional identification by either a printed, waterproof label or a stamped nameplate, indicating manufacturer's name and product model number.

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 method in ASTM F 446.
C. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to manufacturer's instructions for type of substrate involved.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
B. Remove temporary labels and protective coatings.
C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

**END OF SECTION 10 28 00**

# SECTION 10 43 13 - DEFIBRILLATOR CABINETS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:
   1. Automated defibrillator cabinets (AED) for the following:
      a. Automated external defibrillators (AED)
      b. Provide defibrillator for each cabinet

### 1.3 REFERENCES

A. American Heart Association (AHA):
   1. American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care - current Edition.

### 1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for AED cabinets.
   1. Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
   2. Automated External Defibrillator
B. Shop Drawings: For AED cabinets. Include plans, elevations, sections, details, and attachments to other work.
C. Samples for Verification: For each type of exposed finish required, prepared Samples:
D. Maintenance Data: For cabinets and AED's to include in maintenance manuals.

### 1.5 QUALITY ASSURANCE

A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

### 1.6 COORDINATION

A. Coordinate size of cabinets to ensure that defibrillator indicated are accommodated.
B. Coordinate sizes and locations of cabinets with wall depths.

1.7 SEQUENCING

A. Apply vinyl lettering on field-painted after painting is complete.

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.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and protect defibrillator cabinets and related materials using means and methods that will prevent damage, deterioration, or loss.
   1. Deliver components in manufacturer's original packaging, properly labeled for identification.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
B. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.2 AUTOMATED DEFIBRILLATOR CABINET

A. General: Provide cabinets and defibrillator where indicated, of suitable size for housing device indicated. Provide UL rated cabinets in any rated wall assemblies.
B. Cabinet Type: Suitable for mounting AED
   1. Basis of Design Product: JL Industries; 1400 Lifestart Series
      a. Potter Roemer LLC
      b. Larsen's Manufacturing Company
      c. Or equal
C. Cabinet Construction: Nonrated.
D. Cabinet Trim Material: Stainless-steel sheet.
E. Cabinet Material: Steel sheet.
F. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
   1. Rolled-Edge Trim: 1-1/4-inch backbend depth.
G. Cabinet Trim Material: Same material and finish as door.
H. Door Material: Aluminum sheet.
I. Door Style: Fully glazed panel with frame.
J. Door Glazing: Tempered float glass (clear).
K. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
   1. Provide continuous hinge, of same material and finish as trim or concealed hinge permitting door to open 180 degrees.
L. Accessories:

1. Mounting Bracket: Manufacturer's standard steel of sizes required for types and capacities of device indicated, with plated or baked-enamel finish.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.

M. Finishes:
1. Manufacturer's standard baked-enamel paint for the following:
a. Interior of cabinet.
2. Aluminum: Clear anodic.

## 2.3 FABRICATION

A. Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.

Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

## 2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.5 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm.

## 2.6 STEEL FINISHES

A. Factory Prime Finish: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

## 2.7 AUTOMATED ECTERNAL DEFIBRILLATORS

A. Provide defibrillator for each cabinet as follows:
1. Defibrillators shall meet local and national standards for Emergency Care in Public Places and are FDA Approved.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where **semirecessed** cabinets will be installed.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for **semirecessed** fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
B. Cabinets: Fasten cabinets to structure, square and plumb.
   1. Unless otherwise indicated, provide recessed cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed cabinets.
   2. Provide inside latch and lock for break-glass panels.
   3. Fasten mounting brackets to inside surface of cabinets, square and plumb.
C. Identification: Apply vinyl lettering at locations indicated.
D. Where exact location of surface-mounted cabinets is not indicated, locate as directed by Architect.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
B. Adjust cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
C. On completion of cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
D. Touch up marred finishes, or replace cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by cabinet manufacturers.
E. Replace cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

**END OF SECTION 10 43 13**

# SECTION 10 44 13 - FIRE EXTINGUISHER CABINETS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:
   1. Fire protection cabinets for the following:
      a. Portable fire extinguishers.
      b. Fire extinguisher cabinets (FEC)
      c. Fire extinguisher brackets (FEB)
      d. Fire extinguisher for each cabinet and bracket

### 1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.
   1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
   2. Show location of knockouts for hose valves.

B. Product Schedule: For fire protection cabinets. Coordinate final fire protection cabinet schedule with fire extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

C. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

### 1.4 QUALITY ASSURANCE

A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

### 1.5 COORDINATION

A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate size of fire protection cabinets to ensure that type and capacity of fire hoses, hose valves, and hose racks indicated are accommodated.

C. Coordinate sizes and locations of fire protection cabinets with wall depths.

1.6 SEQUENCING

A. Apply vinyl lettering on field-painted, fire protection cabinets after painting is complete.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.2 FIRE PROTECTION CABINET

A. General: Provide fire extinguisher cabinets and fire extinguisher where indicated, of suitable size for housing fire extinguishers of types and capacities indicated. Provide UL rated cabinets in any rated wall assemblies.

B. Cabinet Type: Suitable for fire extinguisher.
1. Products: Subject to compliance with requirements, provide one of the following:
a. J. L. Industries, Inc., a division of Activar Construction Products Group;
b. Kidde Residential and Commercial Division, Subsidiary of Kidde plc;
c. Larsen's Manufacturing Company;
d. Modern Metal Products, Division of Technico Inc.;

C. Cabinet Construction: non-fire rated.

D. Cabinet Material: Steel sheet.

E. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
1. Rolled-Edge Trim: 1-1/4-inch backbend depth.

F. Cabinet Trim Material: Same material and finish as door.

G. Door Material: Aluminum sheet.

H. Door Style: Fully glazed panel with frame.

I. Door Glazing: Tempered float glass (clear).

J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
1. Provide continuous hinge, of same material and finish as trim or concealed hinge permitting door to open 180 degrees.

K. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect. for signage.

L. Finishes:
1. Manufacturer's standard baked-enamel paint for the following:
   a. Interior of cabinet.
2. Aluminum: Clear anodic.

## 2.3 FABRICATION

A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.

Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

## 2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.5 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm.

## 2.6 STEEL FINISHES

A. Factory Prime Finish: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

2.7 FIRE EXTINGUISHER

A. Provide extinguisher for each cabinet and bracket as follows:
   1. Multi-Purpose Dry Chemical Type: UL-rated 4-A:60-B:C, 10 pound nominal capacity, enameled steel container, for Class A, B, and C fires.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where **semirecessed** cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for **semirecessed** fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
   1. Unless otherwise indicated, provide recessed fire protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire protection cabinets.
   2. Provide inside latch and lock for break-glass panels.
   3. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.
C. Identification: Apply vinyl lettering at locations indicated.
D. Where exact location of surface-mounted cabinets and bracket- mounted fire extinguishers is not indicated, locate as directed by Architect.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.
E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

**END OF SECTION 10 44 13**

# SECTION 105113 - METAL LOCKERS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:
   1. Knocked-down, athletic metal lockers.
      a. Double Tier (2) 24”W X 24”D X 72”H
   2. Locker benches.

### 1.3 DEFINITIONS

A. Uncoated Steel Sheet Thicknesses: Indicated as the minimum thicknesses.

### 1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker and bench.
B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Show base, sloping tops, filler panels and other accessories.
   2. Include locker identification system.
C. Samples for Initial Selection: For units with factory-applied color finishes.
D. Samples for Verification: For metal lockers and locker benches, in manufacturer's standard sizes.
E. Qualification Data: For Installer.
F. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.
G. Warranty: Special warranty specified in this Section.

### 1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of metal locker manufacturer for installation and maintenance of units required for this Project.
B. Source Limitations: Obtain metal lockers and accessories through one source from a single manufacturer.
C. Regulatory Requirements: Where metal lockers are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), ICC A117.1., FED-STD-795, "Uniform Federal Accessibility Standards.".
   1. Provide hardware that does not require tight grasping, pinching, or twisting of the wrist, and that operates with a force of not more than 5 lbf.
D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section “Project Management and Coordination.”

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for metal locker installation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify the following by field measurements before fabrication and indicate measurements on Shop Drawings:
   1. Concealed framing, blocking, and reinforcements that support metal lockers before they are enclosed.
   2. Recessed openings.
   3. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish recessed opening dimensions and proceed with fabricating metal lockers without field measurements. Coordinate wall and floor construction to ensure that actual recessed opening dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
      b. Faulty operation of latches and other door hardware.
   2. Damage from deliberate destruction and vandalism is excluded.
   3. Warranty Period for Knocked-Down Metal Lockers: Two (2) years from date of Substantial Completion.

1.10 EXTRA MATERIALS

A. Furnish extra materials described below, before construction begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Full-size units of the following metal locker hardware items equal to (10) ten percent of amount installed for each type and finish installed, but no fewer than (5) five units:
      a. Identification plates.
      b. Hooks.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: The design for each metal locker specified is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by other manufacturers.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS) Type B, suitable for exposed applications.
B. Fasteners: Zinc- or nickel-plated steel, slotless-type exposed bolt heads, and self-locking nuts or lock washers for nuts on moving parts.
C. Anchors: Select material, type, size, and finish required for secure anchorage to each substrate.
   1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance.

2.3 KNOCKED-DOWN, HEAVY DUTY ATHLETIC METAL LOCKERS

A. Basis-of-Design Product: Penco Products, Inc., Invincible II
B. Locker Arrangement: Double tier.
C. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated, cold-rolled steel sheet with thicknesses as follows:
   1. Sides, Bottoms, Tops:
      a. 16 gauge steel.
      b. Ventilation: 3/4 inch (10mm) wide by 1-1/2 inch (38 mm) high diamond-shaped perforations.
   2. Backs: Solid 18 gauge steel.
D. Hinges:
   1. Hinge: 0.074 inch (1.88 mm) thick sheet steel, double spun, full loop, tight pin, projection welded to door frame and securely fastened to the door.
      a. Two 2 inch (51 mm) high five-knuckle hinges.
E. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond face of door; pry resistant.
   1. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks, built-in cylinder locks, or padlocks; positive automatic and prelocking.
      a. Latch Hooks: Equip doors less than **48 inches** high with 2 latch hooks; fabricated from minimum 0.1116-inch thick steel; welded to full-height door strikes; with resilient silencer on each latch hook.
      b. Latching Mechanism: Manufacturer's standard rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.
F. Equipment: Equip each metal locker with identification plate and the following, unless otherwise indicated:
   1. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.
G. Accessories:
   1. Legs: **6 inches** high; fabricated from 0.0677-inch thick, cold-rolled steel sheet; welded to bottom of locker.
      a. Closed Front and End Bases: Fabricated from 0.0428-inch thick, cold-rolled steel sheet.

2. Sloping Tops: Fabricated from minimum 0.0428-inch thick, cold-rolled steel sheet; approximately 20-degree pitch.
   a. Closures: Vertical-end type.
3. Filler Panels: Fabricated from 0.0428-inch thick, cold-rolled steel sheet.
4. Boxed End Panels: Fabricated from 0.0528-inch thick, cold-rolled steel sheet.
5. Number Plates: Provide each locker with a polished aluminum number plate, 2-1/4 inches wide by 1 inch high, with black numerals not less than 3/8 inch high; attach to face of door with two aluminum rivets.

H. Finish: Powder coat.
1. Color(s): As selected by Architect from manufacturer's full range.

## 2.4 LOCKER BENCHES

A. General: Provide locker benches fabricated by same manufacturer as metal lockers.
B. Bench Tops: Manufacturer's standard 1-piece units, of the following material, minimum 9-1/2 inches wide by 1-1/4 inches thick, with rounded corners and edges:
1. Laminated maple with one coat of clear sealer on all surfaces, and one coat of clear lacquer on top and sides.
C. Fixed Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top and anchoring to floor, complete with fasteners and anchors, and as follows:
1. Tubular Steel: 1-1/4-inch diameter steel tubing, with 0.1265-inch thick steel flanges welded at top and base; with baked-enamel finish; anchored with exposed fasteners.
   a. Color: As selected by Architect from manufacturer's full range.

## 2.5 FABRICATION

A. General: Fabricate metal lockers square, rigid, and without warp; with metal faces flat and free of dents or distortion. Make exposed metal edges free of sharp edges and burrs, and safe to touch.
1. Form body panels, doors, shelves, and accessories from one-piece steel sheet, unless otherwise indicated.
2. Provide fasteners, filler plates, supports, clips, and closures as required for a complete installation.
B. Unit Principle: Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.
C. Knocked-Down Construction: Fabricate metal lockers for nominal assembly at Project site using nuts, bolts, screws, or rivets. Factory weld frame members together to form a rigid, one-piece assembly.
D. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.
E. Identification Plates: Manufacturer's standard etched, embossed, or stamped aluminum plates; with numbers and letters at least 3/8 inch high.
F. Legs: Formed by extending vertical frame members or by attaching gusset-type legs to locker body; with provision for fastening to floor; finished to match lockers.
1. Closed Front and End Bases: Fabricate bases without overlap or exposed fasteners; finished to match lockers.
G. Sloping Tops: Fabricated in lengths as long as practicable, without visible fasteners at splice locations; finished to match lockers.
1. Sloped top corner fillers, mitered.
H. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip joint filler angle formed to receive filler panel.
I. Boxed End Panels: Fabricated with 1-inch wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.
J. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

2.6 STEEL SHEET FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
B. Factory finish steel surfaces and accessories except stainless-steel and chrome-plated surfaces.
C. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond. Use manufacturer's standard methods.
D. Baked-Enamel Finish: Immediately after cleaning, pretreating, and phosphatizing, apply manufacturer's standard thermosetting baked-enamel finish. Comply with paint manufacturer's written instructions for application, baking, and minimum dry film thickness.
E. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard baked-polymer thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install level, plumb, and true; shim as required, using concealed shims.
   1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion, using concealed fasteners.
   2. Anchor single rows of metal lockers to walls near top and bottom of lockers.
   3. Anchor back-to-back metal lockers to floor.
B. Knocked-Down Metal Lockers: Assemble knocked-down metal lockers with standard fasteners, with no exposed fasteners on door faces or face frames.
C. Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
   1. Attach hooks with at least two fasteners.
   2. Attach door locks on doors using security-type fasteners.
   3. Identification Plates: Identify metal lockers with identification indicated on Drawings.
      a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
      b. Attach plates to upper shelf of each open-front metal locker, centered, with a least two aluminum rivets.
   4. Attach filler panels with concealed fasteners. Locate fillers panels where indicated on Drawings.
   5. Attach sloping top units to metal lockers, with closures at exposed ends.
   6. Attach boxed end panels with concealed fasteners to conceal exposed ends of nonrecessed metal lockers.
   7. Attach finished end panels with fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.
B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit metal locker use during construction.
C. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal locker manufacturer.

**END OF SECTION 105113**

# SECTION 10 73 26 – WALKWAY COVERINGS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

### 1.2 DESCRIPTION OF WORK

A. Extent of pre-engineered walkway canopy work is shown on drawings.
   1. Work includes design, fabrication and installation of a complete welded, extruded aluminum protective cover system.
B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 03 Section “Cast-In-Place Concrete” for concrete foundations.

### 1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product information, specifications and installation instructions for canopy components and accessories.
B. Shop Drawings: Submit complete erection and shop drawings sealed by an engineer registered in North Carolina showing anchor bolts settings and roof framing, transverse cross sections, covering and trim details, and accessory installation details to clearly indicate proper assembly of canopy components.
C. Samples: Submit samples of the following items. Architect's review will be for color and texture only. Compliance with other requirements is the responsibility of the Contractor.
   1. 12" long by actual width of roofing panels, with required finishes.
   2. Fasteners for application of roofing panels.
   3. Sealants and closures.
D. Certification: Submit written Certification prepared and signed by a Professional Engineer, registered to practice in the State where walkway is to be erected, verifying that walkway design meets indicated loading requirements and codes of authorities having jurisdiction.

### 1.4 QUALITY ASSURANCE

A. Design Criteria:
   1. Structural Framing: Design primary and secondary structural members and exterior covering materials for applicable loads and combinations of loads in accordance with the Metal Building Manufacturers Association's (MBMA) "Design Practices Manual".
   2. Welded connections: Comply with requirements of the American Welding Society's (AWS) "Standard Code for Arc and Gas Welding in Building Construction" for welding procedures.
B. Engineered Structural Design: Provide design calculations and drawings prepared by a Professional Engineer, licensed in the State of N.C., for the design of the pre-engineered walkway canopy.
   1. Structure shall be engineered to meet the required structural loads including but not limited to a design wind speed of 146mph.
C. Manufacturer's Qualifications: Provide pre-engineered walkway canopy system as produced by a manufacturer with not less than 5 years successful experience in the fabrication of pre-engineered canopies of the type and quality required.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store prefabricated components, sheets, panels, and other manufactured items so they will not be damaged or deformed.
   1. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight ventilated covering. Store metal sheets or panels so that water accumulations will drain freely. Do not store sheets or panels in contact with other materials which might cause staining.

PART 2 - PRODUCTS

2.1 PRE-ENGINEERED ALUMINUM CANOPY WALKWAY SYSTEM

A. Provide a complete aluminum walkway cover system with columns, beams, roofing, fascias, gutters, downspouts, etc. as indicated on the drawings and describe herein.
   1. System shall be entirely of extruded aluminum. Understructure shall consist of heli-arc welded one-piece bents and the deck of interlocking aluminum. Structure shall be capable of sustaining severe icing, hail, hurricane winds, and being walked upon.

B. Subject to compliance with the requirements, comparable and equal products of the following companies, but not limited too, are acceptable:
   1. Dittmer Architectural Aluminum, Winter Springs, FL
   2. Peachtree Products
   3. Mitchell Metals
   4. Mapes Canopies, LLC

2.2 MATERIALS

A. Aluminum Sections: All aluminum sections shall be 6063 alloy heat-treated to a T-6 temper.
B. Fasteners: All deck screws shall be type 18-8 stainless steel, sealed with neoprene "O" ring beneath stainless steel. Trim rivets may be aluminum.
C. Grout: Grout shall be 3:1 Portland cement to masonry sand, 2,000 psi compressive strength.

2.3 FABRICATION

A. Bent Construction: Beams and columns shall be heli-arc welded into rigid, one-piece units in the manufacturer's plant. Column ends shall be pierced to "key" grout to bent for maximum uplift protection.
B. Roof Deck: Self-flashing deck sections interlocked into a composite unit spanning double bays for positive locking. Deck shall be staked into a camber sufficient to off-set deadload deflection and cause positive drainage on spans over 15'-0". Staking shall consist of an abrupt local deformation of deadlock metal, each stake having a shear value in excess of 350 lbs and shall occur as detailed.
   1. All aluminum roof decks shall have a profile similar to Peachtree canopy FS series with flush (smooth) soffit/bottom, 6" rib spacing, minimum 3-1/2" rib height, .087" minimum gauge, interlocking ribs.

C. Aluminum Suspended Canopies
   1. Decks span over at least one support beam and drain to gutter beams that convey water to downspout attached to wall.

D. Internal Drainage: Internal gutter system integral with the system to direct water from deck to columns for discharge into the underground site drainage system. Include weepholes above ground level for emergency overflow.

2.4 ALUMINUM FINISHES

A. Architect shall select the Finish from one of the following. Contractor shall make provisions for the selection of either one of the below listed finishes.
   1. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

2.5 ACCESSORIES

A. Provide the following sheet metal accessories factory formed of the same material and finish as the roofing and siding.
   1. Flashings.
   2. Closers.
   3. Fascia/gutter.

B. Flexible Closure Strips: Provide closed-cell, expanded cellular rubber, self- extinguishing flexible closure strips. Cut or premold closure strips to match corrugation configuration of roofing and siding sheets. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Sealing Tape: Provide pressure sensitive 100 percent solids grey polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, non-sag, non toxic, non staining tape not less than 1/2" wide and 1/8" thick.

D. Joint Sealant: Provide one-part elastomeric polyurethane, polysulfide or silicone rubber sealant as recommended by the building manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION AND ERECTION

A. Install and/or erect the system in accordance with the manufacturer's instructions and recommendations and approved installation/erection drawings.
   1. Install and erect all members straight and true to line as required and as acceptable to Architect.
   2. Set posts in concrete as indicated and/or required.
   3. Install screw fasteners with power tool having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.

3.2 PROTECTION

A. Protect work of other trades. Correct painting related damages by cleaning, repairing or replacing, and refinishing, as directed by the Architect.

**END OF SECTION 10 73 26**

# SECTION 11 05 13 - COMMON MOTOR REQUIREMENTS FOR 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, alternating-current, small and medium, squirrel-cage induction motors, installed at equipment manufacturer's factory, and motors shipped separately by equipment manufacturer for field installation.

### 1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices and features to be compatible with the following:
   1. Motor controllers.
   2. Torque, speed, and horsepower requirements of the load.
   3. Ratings and characteristics of supply circuit and required control sequence.
   4. Ambient and environmental conditions of installation location.

## PART 2 - PRODUCTS

### 2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in equipment schedules or Sections.
B. Comply with NEMA MG 1 unless otherwise indicated.
C. Comply with IEEE 841 for severe-duty motors.

### 2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet 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 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 11 05 13**

# SECTION 11 52 13 - PROJECTION SCREENS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. Section Includes:
1. Electrically operated projection screens and controls.

B. Related Sections:
1. Division 05 Section "Metal Fabrications" for metal support framing for projection screens.
2. Division 06 Section "**Rough Carpentry**" for wood backing for screen installation.

### 1.3 DEFINITIONS

A. Gain of Front-Projection Screens: Ratio of light reflected from screen material to that reflected perpendicularly from a magnesium carbonate surface as determined per SMPTE RP 94.

### 1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For projection screens. Show layouts and types of projection screens. Include the following:
1. For electrically operated projection screens and controls:
a. Location of screen centerline relative to ends of screen case.
b. Location of wiring connections.
c. Drop lengths and width.
d. Anchorage details, including connection to supporting structure for suspended units.
e. Details of juncture of exposed surfaces with adjacent finishes.
f. Accessories.
g. Wiring diagrams.

### 1.5 QUALITY ASSURANCE

A. Source Limitations for Projection Screens: Obtain **projection screens** from single manufacturer. Obtain accessories, including necessary mounting hardware, from screen manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Environmental Limitations: Do not deliver or install projection screens until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.7 COORDINATION

A. Coordinate layout and installation of projection screens with adjacent construction, including ceiling suspension systems, light fixtures, HVAC equipment, and partitions.

PART 2 - PRODUCTS

2.1 ELECTRICALLY OPERATED PROJECTION SCREENS

A. General: Manufacturer's standard units consisting of case, screen, motor, controls, mounting accessories, and other components necessary for a complete installation. **Provide units that are listed and labeled as an assembly by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.**
**Basis of design: Stewart Filmscreen Stealth Grande**
1. Controls: Three-position control switch installed in recessed device box with flush cover plate **matching other electrical device cover plates in room where switch is installed**.
   a. Provide number of control switches indicated **for each screen**.
   b. Provide power supply for low-voltage systems if required.
   c. Provide key-operated, power-supply switch.
2. Motor in Roller: Instant-reversing motor of size and capacity recommended by screen manufacturer; with permanently lubricated ball bearings, automatic thermal-overload protection, preset limit switches to automatically stop screen in up and down positions, and positive-stop action to prevent coasting. Mount motor inside roller with vibration isolators to reduce noise transmission.
3. Screen Mounting: Top edge securely anchored to rigid metal roller and bottom edge formed into a pocket holding a 3/8-inch- diameter metal rod with ends of rod protected by plastic caps.
   a. Roller for motor in roller supported by vibration- and noise-absorbing supports.
4. Tab Tensioning: Provide units that have a durable low-stretch cord, such as braided polyester, on each side of screen connected to edge of screen by tabs to pull screen flat horizontally. **In lieu of tab tensioning, screens may be constructed from vinyl-coated screen cloth that contains horizontal stiffening monofilaments to resist edge curling.**

B. Suspended, Electrically Operated Screens with Automatic Ceiling Closure: **Motor-in-roller** units designed and fabricated for suspended mounting; with bottom of case composed of two panels, fully enclosing screen, motor, and wiring; one panel hinged and designed to open and close automatically when screen is lowered and fully raised, the other removable or openable for access to interior of case.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Motor in Roller:
      1) Da-Lite Screen Company; Boardroom Electrol Director Electrol.
      2) Draper Inc.; Ultimate Access/Series E.
      **3)** Stewart Filmscreen Corporation; **ABT-6 ABT Trap Door**
      **4)** Stewart Filmscreen Corporation; **ABT-6 ABT Trap Door**
   b. Provide screen case with trim flange to receive ceiling finish.
   c. Finish on Exposed Surfaces: **Vinyl covering or baked enamel**.

2.2 FRONT-PROJECTION SCREEN MATERIAL

A. Matte-White Viewing Surface: Peak gain not less than 0.9, and gain not less than 0.8 at an angle of 50 degrees from the axis of the screen surface.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. BEI Audio-Visual Products; High Contrast Matte White.
      b. Bretford, Inc.; High Contrast Matte White.
      c. Da-Lite Screen Company; High Contrast Matte White.
      d. Draper Inc.; High Contrast Matte White
      e. Stewart Filmscreen UltraMatte150.

PART 3 - EXECUTION

3.1 FRONT-PROJECTION SCREEN INSTALLATION

A. Install front-projection screens at locations indicated to comply with screen manufacturer's written instructions.

B. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.
   1. Install low-voltage controls according to NFPA 70 and complying with manufacturer's written instructions.
      a. Wiring Method: Install wiring in raceway 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.
   2. Test electrically operated units to verify that screen controls, limit switches, closures, and other operating components are in optimum functioning condition.
   3. Test manually operated units to verify that screen-operating components are in optimum functioning condition.

3.2 PROTECTING AND CLEANING RIGID REAR-PROJECTION SCREENS

A. Provide temporary covering of rear-projection screens until time of Substantial Completion. Use type of covering approved by screen manufacturer that will effectively protect screen from abrasion, breakage, or other damage.

B. Clean rear-projection screens on both faces immediately before date scheduled for inspection intended to establish date of Substantial Completion. Use methods and cleaning materials recommended by screen manufacturer, taking care not to scratch or damage optical coatings or screen substrates.

3.3 PROJECTION SCREEN SCHEDULE

A. Electrically Operated, Front-Projection Screen **suspended, with automatic ceiling closure**.
   a. Motor Configuration: **Motor in roller**.
   b. Screen Surface: High Contrast **Matte white**.
   c. Format: 16:10
   d. Diagonal size: 226”
   e. Viewing Surface Size: **120”H by 192”W**
   f. Extra Drop Length: As needed at top of screen for bottom of screen to be **36 inches** above floor.
   g. Refer to Contract Drawings for Location and Quantities.

**END OF SECTION 11 52 13**

# SECTION 11 66 23 - GYMNASIUM EQUIPMENT

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following gymnasium equipment:
   1. Basketball equipment.
   2. Volleyball / Tennis equipment.
   3. Badminton equipment/
   4. Exercise equipment.
   5. Safety pads.

B. Related Sections include the following:
   1. Division 03 Section "Cast-in-Place Concrete" for installation of floor insert sleeves to be cast in concrete slabs and footings.
   2. Division 26 Sections for electrical service for motor operators, controls, and other powered devices for motorized gymnasium equipment.

### 1.3 DEFINITIONS

A. NAGWS: The National Association for Girls and Women in Sport.
B. NFHS: The National Federation of State High School Associations.
C. USAV: USA Volleyball.

### 1.4 PERFORMANCE REQUIREMENTS

A. Refer to structural loads and structural members indicated on the drawings and coordinate equipment loads and mounting requirements as needed for a secure, complete installation.
B. Coordinate all equipment and controls with building architectural, mechanical and electrical systems to avoid conflicts.

### 1.5 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. If applicable, include assembly, disassembly, and storage instructions for removable equipment.
   2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.

B. Shop Drawings: For gymnasium equipment. Include plans, elevations, sections, details, attachments to other work, and the following:
   1. Method of field assembly for removable equipment, connections, installation details, mountings, floor inserts, attachments to other work, and operational clearances.
   2. Transport and storage accessories for removable equipment.

C. Structural analysis data signed and sealed by the qualified professional engineer licensed in North Carolina responsible for their preparation including loads, point reactions, and locations for attachment of gymnasium equipment to structure.
D. Coordination Drawings: Court layout plans, drawn to scale, and coordinating floor inserts, game lines, and markers applied to finished flooring.
E. Samples for Initial Selection: For each type of gymnasium equipment indicated.
F. Samples for Verification: For the following products:
   1. Basketball, Volleyball Net: Full size.
   2. Volleyball Floor Insert: Full-size unit.
   3. Volleyball Post Standard: Full-size unit.
   4. Pad Fabric: Not less than 3 inches square, with specified treatments applied. Mark face of material.
G. Product Certificates: For each type of gymnasium equipment, signed by product manufacturer.
H. Qualification Data: For Installer.
I. Operation and Maintenance Data: For gymnasium equipment to include in emergency, operation, and maintenance manuals.
   1. Provide electronic copies of all operations and maintenance in addition to printed copies.
J. Warranty: Special warranty specified in this Section.

## 1.6 QUALITY ASSURANCE

A. Installer Qualifications: Employees of the equipment manufacturer or an employer of workers trained and approved by manufacturer.
B. Source Limitations: Obtain each type of gymnasium equipment through one source from a single manufacturer.
C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

## 1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install gymnasium equipment until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
B. Field Measurements: Verify position and elevation of floor inserts and layout for gymnasium equipment.

## 1.8 COORDINATION

A. Coordinate installation of floor inserts with structural floors and finish flooring installation and with court layout and game lines and markers on finish flooring.
B. Coordinate layout and installation of overhead-supported gymnasium equipment and suspension system components with other construction including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

## 1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of gymnasium equipment that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Basketball backboard failures including glass breakage.

b. Faulty operation of inserts and all structural components.
c. Electrical operators, motors and controls.

2. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Extruded Bars, Profiles, and Tubes: ASTM B 221.
2. Cast Aluminum: ASTM B 179.
3. Flat Sheet: ASTM B 209.

B. Steel: Comply with the following:
1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Steel Tubing: ASTM A 500 or ASTM A 513, cold formed.
3. Steel Sheet: ASTM A 1011/A 1011M.

C. Support Cable: Manufacturer's standard galvanized steel aircraft cable with a breaking strength of 7000 lb. Provide fittings complying with cable manufacturer's written instructions for size, number, and method of installation.

D. Support Chain and Fittings: Grade 80 hardened alloy steel chain rated for overhead lifting, ASTM A 391/A 391M, with commercial-quality, hot-dip galvanized steel connectors and hangars.

E. Castings and Hangers: Malleable iron, ASTM A 47/A 47M, grade required for structural loading.

F. Softwood Plywood: DOC PS 1, exterior.

G. Medium-Density Fiberboard: ANSI A208.2, made with adhesive containing no urea formaldehyde.

H. Equipment Wall-Mounting Board: Wood, neutral-color painted finish, size, and quantity as required to mount gymnasium equipment according to manufacturer's written instructions.

I. Anchors, Fasteners, Fittings and Hardware: Manufacturer's standard corrosion-resistant or noncorrodible units; concealed; vandal- and theft-resistant design.

J. Grout: Nonshrink, nonmetallic, premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107 with minimum strength recommended in writing by gymnasium equipment manufacturer.

### 2.2 BASKETBALL EQUIPMENT

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product meeting the parameters indicated on Drawings by one of the following:
1. AALCO Manufacturing.
2. Arizona Courtlines, Inc.
3. ADP Lemco Inc.
4. Basketball Products International; a division of American Athletic, Inc.
5. Bison Inc.
6. Douglas Industries, Inc.
7. Draper Inc.
8. Institutional Products Inc.
9. Jaypro Sports, LLC.
10. L. A. Steelcraft.
11. Performance Sports Systems.
12. Porter Athletic Equipment Company.
13. P. W. Athletic Mfg. Co.

D. General: Provide equipment complying with requirements in NFHS's "NFHS Basketball Rule Book."

E. Protruding fasteners or exposed bolt heads on front face of backboards are not permitted.

F. Overhead-Supported Backboard as indicated on the drawings:
   1. Folding Type: Provide manufacturer's standard assembly for forward-folding, front-braced backboard, with hardware and fittings to permit folding.
   2. Framing: Steel pipe, tubing, and shapes. Design framing to minimize vibration during play.
      a. Center-Mast Frame: Welded and bolted or clamped with side sway bracing.
      b. Finish: Manufacturer's standard powder-coat finish.

G. Backboard Safety Device: Designed to limit free fall if support cable, support chain, pulleys, fittings, winch, or related components fail; with mechanical automatic reset; 6000-lb load capacity; one per each folding backboard over bleacher areas.

H. Backboard Electric Operator: Provide operating machine of size and capacity recommended by manufacturer for equipment specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, and remote controls. Coordinate wiring requirements and electrical characteristics with building electrical system.
   1. Operator Type: Cable drum with grooved drum and cable tension device to automatically take up cable slack and retain cable in grooves.
   2. Operator Mounting: top mounted
   3. Motor Characteristics: Sufficient to start, accelerate, reverse, and operate connected loads at designated speeds within installed environment and with indicated operating sequence, and without exceeding nameplate rating or considering service factor. Comply with NEMA MG 1, and the following:
   4. Voltage: 120 V.
   5. Horsepower: 1/2hp.
   6. Enclosure: Manufacturer's standard.
   7. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.
   8. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
   9. Phase: One.
   10. Remote-Control Station(s): NEMA ICS 6, Type 1 enclosure for recessed or flush mounting, momentary-contact, three-position switch-operated control with up, down, and off functions.
      a. Group Key Switch Control Stations: One switch per each backboard].
      b. Keys: Provide two keys per station.
      c. Control Station Enclosure: Provide prime-painted metal enclosure with key access with two sets of keys per enclosure.
   11. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop basketball equipment at fully retracted and fully lowered positions.

I. Basketball Backboard:
   1. Shape and Size:

      a. Rectangular, 72 by 42 inches (1800 by 1050 mm), with rounded corners.
   2. Backboard Material: With predrilled holes or preset inserts for mounting goals, and as follows:
      a. Glass: Not less than 1/2-inch- thick, transparent tempered glass. Provide glass with impact-absorbing resilient rubber or PVC gasket around perimeter in a fully welded, brushed-natural-finish, extruded-aluminum frame, with steel subframe, reinforcement, and bracing and with mounting slots for mounting backboard frame to backboard support framing.
         1) Direct Mount: Designed for mounting backboard frame to center mast of backboard framing to maximize relief of stresses on backboard frame and glass.
   3. Target Area and Border Markings: Permanently etched in white color, marked in pattern and stripe width according to referenced rules.

J. Goal Mounting Assembly: Compatible with goal, backboard, and support framing; with hole pattern that is manufacturer's standard for goal attachment.
   1. Glass Backboard Goal Mounting Assembly: Goal support framing and reinforcement designed to transmit load from goal to backboard frame and to minimize stresses on glass backboard.

2. Direct Mount: Designed for mounting goal directly and independently to center mast of backboard support framing so no force, transmitted by ring, is directly applied to backboard and rigidity and stability of goal are maximized.

K. Basketball Goals: Complete with flanges, braces, attachment plate, and evenly spaced loops welded around underside of ring.
1. Single-Rim Basket Ring Competition Goal: Materials, dimensions, and fabrication complying with referenced rules.
2. Type: Movable, breakaway design with manufacturer's standard breakaway mechanism and rebound characteristics identical to those of fixed, nonmovable ring.
3. Mount: Rear.
4. Net Attachment: Loops for tying net to rim.
5. Finish: Powder-coat finish.

L. Basketball Nets: 12-loop-mesh net, between 15 and 18 inches long, sized to fit rim diameter, and as follows:
1. Cord: Made from white nylon.

M. Backboard Safety Pads: Designed for backboard thickness indicated and extending continuously along bottom and up sides of backboard and over goal mounting and backboard supports as required by referenced rules
1. Attachment: Manufacturer's standard.
2. Color: As selected by Architect from manufacturer's full range.

## 2.3 VOLLEYBALL EQUIPMENT

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product meeting the parameters indicated on Drawings by one of the following:
1. AALCO Manufacturing.
2. ADP Lemco Inc.
3. American Athletic, Inc.
4. Arizona Courtlines, Inc.
5. Bison Inc.
6. Douglas Industries, Inc.
7. Draper Inc.
8. Jaypro Sports, LLC.
9. L. A. Steelcraft.
10. Performance Sports Systems.
11. Porter Athletic Equipment Company.
12. P. W. Athletic Mfg. Co.
13. Schelde North America.
14. Sports Imports.

D. General: Provide equipment complying with requirements in NAGWS's "NAGWS Volleyball Rulebook[NFHS's "NFHS Volleyball Rule Book."

E. Floor Insert: Aluminum floor plate; and steel pipe sleeve, concealed by floor plate, with capped bottom end, sized with ID to fit post standards, not less than length required to securely anchor pipe sleeve in structural floor as indicated; with anchors designed for securing floor insert to floor substrate indicated; quantity as indicated.
1. Floor Plate: Lockable swivel access cover, designed for use with floating wood floors and to be flush with adjacent flooring. Provide two tool(s) for unlocking access covers.

F. Post Standards: Removable, two paired volleyball post standards for multicourt play as indicated. Adjustable, telescoping height. Designed for easy removal from permanently placed floor insert supports. Fabricated from combined steel and extruded-aluminum pipe or tubing, with nonmarking plastic or rubber end cap or floor bumper to protect permanent flooring. Finished with manufacturer's standard factory-applied, baked powder-coating finish complying with finish manufacturer's written

instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness or plated metal finish.

1. Nominal Pipe or Tubing Diameter: 4-inch OD at base.
2. Telescopic and Net Height Adjuster System: Provide Manufacturer's standard telescoping system with locking device, telescopic post, and fittings for holding net at selected height; designed for height adjustment of post standard to position net at heights indicated.
    a. Net Heights: Between sitting volleyball net height and boys'/men's volleyball net height, 36 and 95-5/8 inches or more.
3. Height Markers: Clearly marked at regulation play heights for girls/women, boys/men sitting volleyball and tennis.

G. Net: 32 feet long and as follows; 1 per pair of paired post standards:
1. Width and Mesh: 36 inches with 4-1/2-inch- square mesh made of black polyester string.
    a. Hem Band Edges: White, not less than 2-inch- wide top, bottom, and side bindingsnot less than 1-inch- wide tension straps at top, bottom and midpoint of each side end of net; end sleeves for dowels; and lines with linkage fittings threaded through top and bottom hems of binding. Provide lengths of lines and linkage fittings as required to properly connect to and set up net for post standard spacing indicated on Drawings.
        1) Top Line: Not less than 1/8-inch- diameter, galvanized or coated steel cable.
        2) Bottom Line: Not less than 1/4-inch- diameter rope.
2. Dowels: Not less than 1/2-inch- diameter fiberglass or 1-inch- diameter wood. Provide two dowels per net threaded through each side hem sleeve for straightening net side edges.
3. Net Antennas: 3/8-inch- diameter, high-tensile-strength, extruded fiberglass or plastic rods, 72 inches long, extending above top hem band of net, with alternating white and red bands according to competition rules. Provide two antennas per net.
4. Boundary Tape Markers: 2-inch- wide white strip with sleeve for securing net antenna, secured to net top and bottom with hook-and-loop attachment. Provide two tape markers per net for marking court boundaries.

H. Net Tensioning System: Designed to adjust and hold tension of net. Fully enclosed, nonslip manufacturer's standard-type winch with cable length and fittings for connecting to net lines, positive-release mechanism, and manufacturer's standard handle. Provide end post with post top pulley. Provide opposing post with welded steel loops, hooks, pins, or other devices for net attachment and post top grooved line guide.

I. Bottom Net Lock Tightener: Provide manufacturer's standard quick-release-type tension strap, spring-loaded self-locking tensioner, turnbuckle, pulley, or other device and linkage fittings designed to quickly and easily tighten bottom line or net.

J. Safety Pads: Comply with NCAA and NFHS requirements. Provide pads consisting of not less than 1-inch thick, multiple-impact-resistant polyurethane manufacturer's standard foam filler covered by puncture- and tear-resistant, , not less than 14-oz./sq. yd. nylon-reinforced PVC fabric cover; with fire-test-response characteristics indicated. Provide pads with hook-and-loop closure or attachments for the following components:
1. Post Standards: Wraparound style, designed to totally enclose each standard to a height of not less than 72 inches; 1 per post.
2. Fabric Cover Flame-Resistance Ratings: Passes NFPA 701.
3. Fabric Color: As selected by Architect from manufacturer's full range.

K. Post Standard Transporter: Manufacturer's standard wheeled unit designed for transporting a single post.

L. Wall Storage Rack: Manufacturer's standard unit designed for mounting on walls and for storing post standards in vertical position with retaining arms, fittings for padlock, and mounting hardware; number of units as required to provide storage for specified equipment.

M. Storage Cart: Manufacturer's standard wheeled unit designed for transporting and storing volleyball equipment and passing through 36-inch- wide or wider door openings. Fabricate units of welded steel tubing with heavy-duty casters, including not less than two swivel casters. Fabricate wheels from materials that will not damage or mark floors; number of units as required to provide transport and storage for specified equipment.

2.4 SAFETY PADS

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. AALCO Manufacturing.
   2. ADP Lemco Inc.
   3. American Athletic, Inc.
   4. Draper Inc.
   5. Institutional Products Inc.
   6. Jaypro Sports, LLC.
   7. Performance Sports Systems.
   8. Porter Athletic Equipment Company.

B. Safety Pad Surface-Burning Characteristics: ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
   1. Flame-Spread Index: 25 or less
   2. Smoke-Developed Index: 450 or less.

C. Pad Coverings: Provide safety pad fabric covering fabricated from puncture- and tear-resistant, not less than 14-oz./sq. yd PVC-coated polyester or nylon-reinforced PVC fabric treated with fungicide for mildew resistance; with surface-burning characteristics indicated.

D. Wall Safety Pads: Padded wall wainscot panels designed to be attached in a continuous row; each panel section consisting of fill laminated to backer board with visible surfaces fully covered by seamless fabric covering, free of sag and wrinkles and firmly attached to back of backer board.
   1. Backer Board: Not less than 3/8-inch- thick plywood, mat formed, or composite panel.
   2. Fill: Multiple-impact-resistant foam not less 1-1/2-inch- thick bonded polyurethane, 6.0-lb/cu. ft. density
   3. Size: Each panel section, 24 inches wide by not less than 72 inches long.
   4. Number of Panel Sections: As indicated modular panel sections.
   5. Installation Method: Concealed mounting Z-clips
   6. Fabric Covering Color(s): As selected by Architect from manufacturer's full range for two color(s).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for play court layout, alignment of mounting substrates, installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance.
   1. Verify critical dimensions.
   2. Examine supporting structure and subfloors and footings below finished floor.
   3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements have been clearly marked. Locate reinforcements and mark locations.
   4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written installation instructions and competition rules indicated for each type of gymnasium equipment. Complete equipment field assembly, where required.

B. Unless otherwise indicated, install gymnasium equipment after other finishing operations, including painting, have been completed.

C. Permanently Placed Gymnasium Equipment and Components: Rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated on Shop Drawings; in proper relation to adjacent construction; and aligned with court layout.
   1. Floor Insert Location: Coordinate location with application of game lines and markers.
   2. Floor Insert Elevation: Coordinate installed heights of floor insert with installation and field finishing of finish flooring and type of floor plate.
   3. Operating Gymnasium Equipment: Verify clearances for movable components of gymnasium equipment throughout entire range of operation and for access to operating components.

D. Floor Insert Setting: Position sleeve in oversized, recessed voids in concrete slabs and footings. Clean voids of debris. Fill void around sleeves with grout, mixed and placed to comply with grout manufacturer's written instructions. Protect portion of sleeve above subfloor and footing from splatter. Verify that sleeves are set plumb, aligned, and at correct height and spacing; hold in position during placement and finishing operations until grout is sufficiently cured. Set insert so top surface of completed unit is flush with finished flooring surface.

E. Wall Safety Pads: Mount with bottom edge at 6 inches above finished floor.

F. Anchoring to In-Place Construction: Use anchors and fasteners where necessary for securing built-in and permanently placed gymnasium equipment to structural support and for properly transferring load to in-place construction.

G. Connections: Connect automatic operators to building electrical system.

H. Removable Gymnasium Equipment and Components: Assemble in place to verify that equipment and components are complete and in proper working order. Instruct Owner's designated personnel in properly handling, assembling, adjusting, disassembling, transporting, storing, and maintaining units. Disassemble removable gymnasium equipment after assembled configuration has been approved by Architect and Owner, and store units in location indicated on Drawings.

## 3.3 ADJUSTING

A. Adjust movable components of gymnasium equipment to operate safely, smoothly, easily, and quietly, free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and moving parts.

## 3.4 CLEANING

A. After completing gymnasium equipment installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.

B. Replace gymnasium equipment and finishes that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

## 3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gymnasium equipment. Refer to Division 01 Section "Demonstration and Training."

**END OF SECTION 11 66 23**

# SECTION 11 66 43 – GYMNASIUM SCOREBOARDS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes: Interior, electronic, multi-sport, multi-purpose basketball/volleyball/wrestling scoreboard(s) including control center, and other accessories for complete functional installation.
   1. Section 11 66 23 Gymnasium Equipment

### 1.2 REFERENCES

A. American Society for Testing and Materials (ASTM) Publications:
   1. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
B. National Electrical Code.
C. Federal Communications Commission, Part 15 Rules & Regulations.
D. UL and C-UL Standard for Electric Signs

### 1.3 SUBMITTALS

A. Product Data: Product data for scoreboards, controls, and accessories shall include descriptions of control functions etc.
B. Shop Drawings: Show fabrication and installation details for scoreboard(s).
   1. Installation drawings, face layout, dimensions, construction, electrical wiring diagrams, and method of anchorage.
   2. Manufacturer's installation instructions.
C. Samples: For each color required.

### 1.4 QUALITY ASSURANCE

A. Source limitation: All components including scoreboard, control center, control cable, and other accessories and installation hardware shall be products of a single manufacturer.
B. Scoreboards and other electrical components shall be certified for use in United States and Canada by Underwriter Laboratories, (UL), Inc. and shall bear either UL or C-UL label only.
C. Scoreboards and other electrical components shall be electrically grounded in accordance with National Electrical Code (NEC), Article 600.

### 1.5 WARRANTY

A. Warranty to cover defects in materials and workmanship for a period of five (5) years from the date of completion against defects in workmanship or materials.

   1. Wireless components, portable scoreboards and solar power kit carry a two (2) year warranty from date of completion. Hand-held controls and switches carry a one (1) year warranty from date of completion.
   3. Lifetime telephone support.

## PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis of Design: Nevco 2700
B. Electro-Mech, or approved equal.

2.2 MATERIALS

A. Aluminum face and perimeter frame: Fabricated from 0.050 inch minimum thickness, ASTM B221 aluminum sheet.
B. Finish: Acrylic polyurethane paint. Color as selected by Architect from manufacturer's standard range.
C. LED (light emitting diode) units: Seven-bar, segmented digits in protective aluminum cover, rated typical life 100,000 hours, and designed to provide excellent visibility from all angles and sides.
D. Provide location specific universal power cord with plug for world-wide installation.

2.3 SCOREBOARDS

A. Type: Interior, multi-purpose basketball/volleyball/wrestling electronic scoreboard with two integral horns, LED displays for time, scores, period, bonus, double bonus, and next possession arrows. Only LED lighting shall be used for rear-lit captions, incandescent lighting excluded. No captions shall be applied directly to the face of the scoreboard. All caption plates will be changeable and made of polyvinylchloride with vinyl lettering applied.
    1. Size: 8 feet long x 3 feet high x 8 inches deep.
    2. Approximate hanging weight: 71 pounds.
    3. Large black and white captions providing maximum visibility:
        a. 6 inches high: "Home", "Guests", and "period".
    4. LED displays:
        b. Timing: Super Bright Red or White 13 inches high digits.
        c. Team scores: Super Bright Amber or White 13 inches high digits.
        d. Period: Super Bright Amber or White 9 inches high digits.
        e. Next possession: Super Bright Amber or White arrow for each team.
        f. Include bonus and double bonus in the form of a 4 inch Super Bright Red or White LED “B”.
    5. Rear-lit captions (when specified) shall require zero maintenance.
    6. Provide Advertising /Team logo area 12” x 12” minimum.
    7. Suspension or wall mounting attachments will be included as necessary.
    8. Power requirement: All options included: 126 Watts, MAX, 100-240 Volts AC w/Power Factor Correction.

2.4 ACCESSORIES/OPTIONS

A. Electrical junction boxes, conduits, and other accessories as required for installation are to be provided by others.
B. Electronic Team Names: “HOME” and “GUEST” caption plates to be replaced with programmable Electronic Team Names.
C. Provide rear-lit caption plate option.
D. Provide for optional Team Name in place of “HOME”.

2.5 CONTROL CENTER

A. Type: Wireless, microprocessor based, operator's control center with receiver unit mounted at scoreboard and designed to operate different models of scoreboard by interchange of keyboard overlay.
    1. Unit shall comply with Part 15 of FCC Rules regarding interference.
    2. Console: High impact, break-resistant plastic.

3. Features:
    a. Control can be used to operate both wireless and wired scoreboards.
    b. Power on-off switch.
    c. Split and raised 40 key keyboards, internal beeper acknowledging each entry, and bookmark capabilities.
    d. Keyboard overlays for scoreboard or accessory.
    e. Remote hand-held main time switch with integral horn button.
    f. Provide with LED displays, lithium cell battery backup to maintain scoreboard memory and time of day, self test mode, power on-off switch, alternate time control, and multiple scoreboard operation.
    g. Timer features: Time of day display, multiple time out timers with warning, interval horn, up count auto stop with horn, and $1/10^{th}$ second display during last minute.
    h. Dimmer control for scoreboard.
4. Receiver: Sturdy impact resistant construction, with antenna mounted at scoreboard.
5. Maximum range: 1,000 feet from control center to receiver.
6. Power adapters: Provide for each control center.
    a. Input: 120 volts, 0.4 amps, 50/60 Hz.
    b. Output: 9 volts, 1.67 amps, 15 watts.
7. Provide option of battery supply for control operation if utility power not available.
8. Provide carrying case for control center and hand-held switch.
    a. Construction: Double wall, high density black polyethylene with padded interior, mechanical latches, and hinges.

B. Type: Handheld wireless, basic, AA battery operated, sport specific, control center with receiver unit mounted at scoreboard.
1. Unit shall comply with Part 15 of FCC Rules and Regulations.
2. Control unit: High impact, break-resistant black ABS plastic.
3. Features:
    a. Wireless operation within 1000 feet.
    b. Operate multiple scoreboards simultaneously.
    c. System allows multiple controllers to link to individual scoreboards.
    d. High visibility LCD display with a sealed keyboard.
    e. Long battery life with indicator; include two AA batteries.
    f. Single hand operation with a no slip grip.
    g. Built-in belt clip.
    h. Wireless signal strength meter and internal antenna.
4. Receiver: Injection molded case mounted at scoreboard.
5. Maximum range: 1,000 feet from control center to receiver.
6. Power adapters: Provide for each scoreboard receiver.
    a. Input: 120 volts, 0.4 amps, 50/60 Hz.
    b. Output: 9 volts, 1.67 amps, 15 watts.
7. Provide carrying case for up to two control centers.
    a. Construction: Double wall, high density black polyethylene with padded interior, mechanical latches, and hinges.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Verify exact scoreboard and control center quantities and junction box locations with Architect.
B. Coordinate requirements for electrical power, wall blocking, auxiliary framing and supports, suspension cables, and other components to be provided under other Specification Sections to ensure adequate provisions are made for complete, functional installation of scoreboards.
C. Coordinate scoreboard electrical requirements to ensure proper power source, conduit, wiring, and

boxes are provided. Prior to installation, verify type and location of power supply.

3.2 INSTALLATION

A. Install scoreboards and accessories in accordance with manufacturer's instructions and approved installation drawings.
B. Before installation, field test scoreboards and accessories for operating functions. Ensure that scoreboards accurately perform all operations. Correct deficiencies.
C. Rigidly mount scoreboards and accessories level and plumb with brackets and fasteners.
D. Clean exposed surfaces.
E. Protect scoreboards and finishes from other construction operations.

3.3 DEMONSTRATING AND TRAINING

A. Provide demonstration and training session for Owner's representative covering operation and maintenance of electronic scoreboard.

**END OF SECTION 11 66 43**

# SECTION 12 24 13 - ROLLER WINDOW SHADES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes roller shades.
B. Related Sections include the following:
   1. Division 06 Section "Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.

### 1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.
B. Samples for Initial Selection: For each colored component of each type of shade indicated.
   1. Include similar Samples of accessories involving color selection.
C. Samples for Verification:
   1. For the following products:
      a. Shade Material: Not less than 3 inches square, with specified treatments applied. Mark face of material.
D. Window Treatment Schedule: For roller shades. Use same designations indicated on Drawings.
E. Product Certificates: For each type of roller shade, signed by product manufacturer.
F. Qualification Data: For Installer.
G. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for each type of roller shade.
H. Maintenance Data: For roller shades to include in maintenance manuals. Include the following:
   1. Methods for maintaining roller shades and finishes.
   2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.

### 1.4 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.
B. Source Limitations: Obtain roller shades through one source from a single manufacturer.
C. Fire-Test-Response Characteristics: Provide roller shade band materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
   1. Flame-Resistance Ratings: Passes NFPA 701.
D. Product Standard: Provide roller shades complying with WCMA A 100.1.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in factory packages, marked with manufacturer and product name, fire-test-response characteristics, lead-free designation, and location of installation using same designations indicated on Drawings and in a window treatment schedule.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and wet and dirty finish work in spaces, including painting, 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: 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 operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 ROLLER SHADES

A. Available Products: Subject to compliance with requirements, 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 the product indicated on Drawings SWF Contract, a division of Springs Window Fashions or a comparable product by one of the following:
    1. SWF Contract, a division of Springs Window Fashions.
    2. Am-Source International;.
    3. BTX Window Automation, Inc.;.
    4. Draper Inc.;
    5. Hunter Douglas, Inc.; Hunter Douglas Window Fashions Division;.
    6. Levolor; Levolor-Kirsch Window Fashions; a Newell Rubbermaid Company;.
    7. Lutron Shading Solutions by VIMCO;.
    8. MechoShade Systems, Inc
    9. Silent Gliss USA, Inc.;.
    10. Verosol USA, Inc.; OEM Shades Inc
A. Shade Band Material: PVC-coated fiberglass.
    1. Fabric Width as required to cover width of window openings.
    2. Pattern: As selected by the Architect
    3. Style: As selected by Architect from manufacturer's full range
    4. Colors: As selected by Architect from manufacturer's full range of colors.
    5. Material Openness factor : 3% openness,
    6. Material UV Blockage: approximately 95 percent.
    7. Material: Fabric flame retardant, fade and stain resistant, anti-static, anti-microbial and pass NFPA 701-1999 FR and ASTM-G21 and G22.
    8. Bottom Hem: Straight.
A. Rollers: Extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets; with manufacturer's standard method for attaching shade material. Tube shall be engineered with a channel to accept fabric spline. The tube size will be determined by the manufacturer based on window size and fabric selection.
B. Provide capacity for one roller shade band(s) per roller, unless otherwise indicated on Drawings.

C. Direction of Roll: Regular, from back of roller**.**

A. Installation brackets: .125" thick steel and can accommodate overhead, side and face mounting. Fascia panel shall be either 4" snap-on design and made of .062" thick extruded 6063 T-5 aluminum alloy with a powder-coated finish. Brackets shall be universal and painted to match the fascia panels. Color selected from manufacturer's standard color selection.

B. Pocket-Style Headbox: U-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; with a bottom cover consisting of slot opening of minimum dimension to allow lowering and raising of shade and a removable or an openable, continuous metal access panel concealing shade roller, brackets, and operating hardware and operators within.

C. Bottom Bar: Steel or extruded aluminum, with plastic or metal capped ends. Provide exposed-to-view, external type bottom bar with concealed weight bar as required for smooth, properly balanced shade operation.

D. Audiovisual Light-Blocking Shades: provide in . Designed for eliminating all visible light gaps when shades are fully closed; fabricated from blackout shade band material with headbox and bottom bar extended and formed for light-tight joints among shade components and between shade components and adjacent construction.
   1. Side Channels, Sill Channel or Angle, and Perimeter Seals: Manufacturer's standard design for eliminating light gaps when shades are closed.
   2. Shade Band Retention System: Manufacturer's standard design for guiding shade band material through range of travel and holding shade band flat with edges of material within side channels.

E. Mounting: Inside mounting permitting easy removal and replacement without damaging roller shade or adjacent surfaces and finishes.

F. Shade Operation: Manual; with continuous-loop bead-chain, clutch, and cord tensioner and bracket lift operator.
   1. Position of Clutch Operator: Right side of roller, as determined by hand of user facing shade from inside, unless otherwise indicated on Drawings.
   2. Clutch: Capacity to lift size and weight of shade; sized to fit roller or provide adaptor. Glass-reinforced, polyester thermopolymer for wear resistance, smooth operation and corrosion resistance. The clutch is comprised of multi-banded, steel springs that lock the shade in any position when operating the control loop. The clutch mechanism is bi-directional and never requires adjustment or lubrication.
   3. Lift-Assist Mechanism Heavy-duty torsion spring located inside the roller tube. The mechanism reduces the pull force allowing easy lifting of larger shades.
   4. Loop Length: Full length of roller shade.
   5. Bead Chain: Stainless steel
   6. Cord Tensioner Mounting: Wall or Mullion
   7. Operating Function: Stop and hold shade at any position in ascending or descending travel.
   8. Spline system: PVC spline heat-welded to the shade fabric and inserted into a channel on the roller tube. Hem bar shall be an aluminum extrusion enclosed in a fabric hem pocket with heat-welded seams and ends. Battens shall be enclosed in a heat-welded pocket providing additional stabilizing on large shades.

## 2.2 ROLLER SHADE FABRICATION

A. Product Description: Roller shade consisting of a roller, a means of supporting the roller, a flexible sheet or band of material carried by the roller, a means of attaching the material to the roller, a bottom bar, and an operating mechanism that lifts and lowers the shade.

B. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
   1. Lifting Mechanism: With permanently lubricated moving parts.

C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F:
   1. Shade Units Installed between (Inside) Jambs: Edge of shade not more than 1/4 inch from face of jamb. Length equal to head to sill dimension of opening in which each shade is installed.

D. Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting headbox where applicable, roller, and operating hardware and for hardware position and shade mounting method indicated.
E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.
F. Color-Coated Finish: For metal components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.
G. Colors of Metal and Plastic Components Exposed to View: As selected by Architect from manufacturer's full range, unless otherwise indicated.

## 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.
   1. 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, and located so shade band is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

### 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.

**END OF SECTION 12 24 13**

# SECTION 12 35 53 – LABORATORY CASEWORK

## 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 modular casework furniture with finished interiors.
   2. Countertops.
   3. Fixtures.
   4. Sinks, faucets, and plumbing accessories.

B. Related Sections:
   1. General millwork and cabinetry.
   2. Rubber, vinyl or other finished toe base.
   3. Locks master keyed to room doors and other special locks.
   4. Blocking within walls.
   5. Electrical and mechanical runs and connections.

### 1.3 REFERENCES

A. ADA (ATBCB ADAAG): Americans with Disabilities Act Accessibility Guidelines.
B. ANSI/AIHA 9.5: American National Standard for Laboratory Ventilation.
C. ANSI/ASHRAE 110: Method of Testing Performance of Laboratory Fume Hoods.
D. ANSI 2358.1: Minimum Performance Requirements for Emergency Showers.
E. ASTM A167: Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
F. ASTM A 666: Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
G. Architectural Woodwork Institute (AWI): Quality Standards.
H. FS W-C-596: Electrical Power Connector, Plug, Receptacle, and Cable Outlet.
I. NEMA WD 1: General Color Requirements for Wiring Devices.
J. NEMA WD 6:Devices-Dimensional Requirements.
K. NEMA LD 3: High Pressure Decorative Laminates.
L. NFPA 30: Flammable and Combustible Liquids Code.NFPA-45: Standard for Fire Protection for Laboratories Using Chemicals.
N. OSHA 29-CFR-1910.1450: Occupational Exposure to Hazardous Chemicals in Laboratories.
O. SEFA 1: Laboratory Fume Hoods - Recommended Practices.
P. SEFA 7: Laboratory and Hospital Fixtures--Recommended Practices.
Q. SEFA 8: Laboratory Furniture--Casework, Shelving and Tables--Recommended Practices.
R. UL 498: Attachment Plugs and Receptacles.
S. UL 1805: Laboratory Hoods and cabinets, where applicable.
T. FSC: Forest Stewardship Council.
U. CARB: California Air Resources Board.
V. "American Made": Casework wholly manufactured and assembled in USA.

1.4 SUBMITTALS

A. Manufacturer's data sheets on each product to be used, including:
   1. Test reports certifying that the casework finish complies with SEFA-8 standards for chemical and physical resistance performance requirements.
   2. Performance test reports from an independent testing lab on each specified top material.
   3. Preparation instructions and recommendations.
   4. Storage and handling requirements and recommendations.
   5. Installation methods.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Indicate locations of blocking and reinforcements required for installing laboratory casework.
   2. Indicate locations and types of service fittings, together with associated service supply connection required.
   3. Include details of utility spaces.
   4. Include indicators of exposed conduits, if required, for service fittings.
   5. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and other laboratory equipment.
   6. Include coordinated dimensions for laboratory equipment specified in other Sections.Retain paragraph above for single-stage Samples. Retain first two paragraphs below for two-stage Samples. For complicated Sections with many products and materials, name products requiring Samples in a subordinate list.

E. Selection Samples: For each finish product specified, one complete set of color chips representing manufacturer's full range of available colors and patterns.
   1. One set of samples indicating full range of finishes for countertop specified.
   2. One set of casework samples indicating full range of finishes for casework specified.

F. Qualification Data: For qualified Installer and manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Modern plant with proper tools, dies, fixtures and skilled workmen to produce high quality laboratory casework and equipment, and shall meet the following minimum requirements:
   1. Minimum of ten years experience in manufacture in the actual production of specified products. Casework shall be wholly manufactured and assembled in the USA: i.e. “American Made”.
   2. Ten installations of equal or larger size.

B. Installer Qualifications: Firm with 10 years’ experience in installation or application of systems similar in complexity to those required for this project, plus the following:
   1. Authorized distributor of manufacturer.
   2. Factory certified by the manufacturer.

C. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

D. Source Limitations: All casework, work surfaces, service fittings, and accessory equipment shall be supplied by a single laboratory casework dealer.

E. These specifications are intended to determine the level of quality and performance of the requested equipment and not to be restrictive by brand or manufacturer. Bidders offering products which differ from those specified shall provide with their shop drawings an itemized comparison with this specification documenting equivalence for dimensions, quality, and performance. Such documentation shall parallel the attached specifications. Bidders shall highlight minor and major deviations with appropriate reasons and documentation. Failure of any prospective supplier to provide this information will cause shop drawings to be rejected.

F. Proposals are invited from alternate manufacturers only if they comply with the minimum design requirements and the minimum performance requirements. A notarized letter stating full compliance must be included in alternate proposals signed by the President of the dealer to ensure compliance.

G. All materials used and work performed must conform to the laws and ordinances of the state, municipality, or other political subdivision within which work under this contract is performed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until project conditions are ready for installation.
B. Schedule delivery of casework and equipment so that material can be installed immediately following delivery.
C. Protect finished surfaces from soiling or damage during handling and installation.
D. Protect work surfaces throughout the construction period with corrugated cardboard covering the top and securely taped to edges.

1.7 PROJECT CONDITIONS

A. Do not deliver or install equipment until following conditions are met:
   1. Windows and doors are installed and the building is secure and weathertight.
   2. Ceiling, overhead ductwork and lighting are installed.
   3. All painting is completed and flooring is installed.
B. Bracing and Supports (Blocking): The furnishing and installation of framing and reinforcements within walls, floors, or ceiling necessary to adequately support the equipment of this section is not included in this specification.
C. Weather Limitations: Wood casework and related materials require the interior building temperature not less than 65 degrees (F) and not greater than 80 degrees (F) to avoid undue drying of materials subsequently causing structural fatigue and damage. Relative humidity not less than 40 percent, nor more than 60 percent. Additionally, frequent and/or excessive changes in temperature and/or humidity levels during the course of the material installation, or once materials are installed, must be avoided to prevent damage to equipment.
D. Field Measurements: Verify actual room and opening dimensions by field measurements before fabrication.

1.8 WARRANTY

A. Special Warranty: The laboratory furniture contractor shall guarantee all materials and workmanship of equipment provided under this contract for a period of one year from the date of final acceptance of equipment or initial use unless specified differently in this section. Any defects due to the use of improper materials or workmanship occurring within a period of one year from date of final acceptance must be rectified by the responsible contractor at his own expense upon notification by the owner of this condition. Materials or components specified by the owner by trade or brand name shall be warranted by the supplier to the extent of the manufacturer's warranty for such materials or components.
   1. Warranty Period: One year from date of Substantial Completion.
B. Special Warranty: Provide manufacturer's one year warranty against defects in materials and workmanship. Subject to provisions of the warranty, manufacturer agrees to repair or replace non-conforming products or its parts for the warranty period following substantial completion.
   1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the following. Design, materials, construction and finish of casework specified is the minimum acceptable standard of quality for wood laboratory casework. Science casework and equipment scheduled in the drawings, "Science Casework and Equipment Schedule", are shown using ICI product numbers. Provide equal casework in conformance with this specification by one of the following :

1. Kewaunee Scientific Corporation
2. ICI (Campbell Rhea)
3. Diversified Woodcrafts, Inc.
4. Or approved equal

B. Product Designations: Drawings indicate sizes and configurations of laboratory casework by referencing designated manufacturer's catalog numbers. Other manufacturers' laboratory casework of similar sizes, similar door and drawer configurations, and complying with the Specifications, including certification to SEFA-8 standards for construction and chemical resistance, may be requested for approved substitution. Requests for substitutions will be considered in accordance with provisions of Section 01600. No exceptions will be made for casework that is not wholly manufactured and assembled in USA: i.e. "American Made".

## 2.2 CONSTRUCTION

A. Wood veneer on plywood core: ICI, Empire Maple Casework basis-of-design.
B. Cabinet Finish, Interiors and Exteriors Match Finished:
   1. Wood Species: Maple
C. Drawer and Door Styles:
   1. Empire Drawer and Door Styling: Both door and drawer fronts are 3/4 inch (19 mm) thick; have a slight radius to the squared edges.
   2. Full flush overlay, vertical match grain, plain sliced maple veneer doors and drawer fronts have a particleboard core with a plain sliced vertical grain maple and a 1/8 inch (3mm) lumber edge-band.
D. Door and Drawer Hardware Style:
   1. Drawer and door pulls:
      a. AL-3: Extruded aluminum bow style rod design.
   2. Hinges:
      a. SS-1: Heavy-duty, institutional type, 5-knuckle hospital tipped, made from 0.083 inch (2 mm) thick stainless steel. Hinge is semi-concealed, 2 1/2 inches (64 mm) high and has off-set wings; each wing has three screw holes for the door leaf and three screw holes for the case leaf, two of which are slotted for adjustability. Hinges are attached with Euro screws.
   3. Latching Handle:
      a. CP: Latching handle CP LH-1 is chrome plated, 4 1/4 inches (108 mm) long and streamline in design. Handle operates with 1/4 turn. Double door cases have latching handles on the right door and dummy handles on the left door. A three-point latching system provides a positive engagement at the top and bottom of the door with tapered aluminum rods, which pull the door snug when they engage plastic strike plates. The rods are 5/16 inch (8 mm) in diameter and move in nylon guides attached to the back of the door. The middle of the door is secured by a latch plate, which engages the side of the case, or latches behind the left door on cases with double doors.
   4. Locks: Removable core standards (as indicated on construction drawings):
      a. CP: Lock CP SL-1 is laboratory grade, cylinder cam lbck, with a 5-disc tumbler mechanism with a chrome plated face. Tumblers and keys are brass, while plug and cylinder is die cast zinc alloy. A 180-degree turn of the key moves the lock cam into, or out of, a slot cut to receive it. There are 500 key changes standard. Locks are keyed differently, master keyed and furnished with 2 keys per lock. Locks and corresponding keys are alpha-numerically coded for a quick match. Lock CP SL-1 is equipped with a removable core, keying control. With the use of a control key, the key core of the lock assembly can be removed and a new key core inserted, changing the entire locking system in a matter of minutes. Key cores can be held out of the lock assembly until the project is completed, removing the security risk of lost or stolen keys during installation and construction. Casework manufacturer can provide control keys and replacement cores as required. Locks are furnished only when specified.
   5. Drawer Slides:

a. Drawer slides DS-1: Epoxy powder coated, cold rolled steel, heavy-duty with a 100 lbs (45 kilograms) load capacity. They are
equipped with heavy-duty, nylon rollers for smooth effortless operation. Slides have automatic positive stop to prevent drawer's accidental removal, but allow for quick removal without tools. Bottom mounted are also acceptable.

6. File Drawer Slides:
   a. File drawer slides FD-1: Epoxy coated, cold rolled steel, heavy-duty, side mounted, and have a 125 lbs (56.25 kg) load capacity. They are equipped with heavy-duty, ball bearing nylon rollers for smooth effortless operation. Slides are full extension with a positive stop, and a trigger finger release. Bottom mounted are also acceptable.

## 2.3 MATERIALS

A. Maple Lumber: Grade FAS or better, air-dried and kiln dried to 6 percent moisture content, then tempered to 7 to 8 percent prior to fabrication. Lumber exposed to view, is free of stains, splits, shakes, season checks and other similar defects. Other hardwoods are grade FAS or better, air dried to 6 percent moisture content, then tempered to 7 to 8 percent prior to fabrication. Other hardwoods are used in semi-exposed, or unexposed, areas and comply with NHLA grading for FAS or better lumber.

B. Maple Plywood: Plywood is plain sliced, book-matched Oak, select grade A-1, cross-banded, and has a veneer core. The 1 inch (25 mm) or 3/4 inch (19 mm) plywood is a minimum of 7-ply, 1/2 inch (12 mm) is a minimum of 5 ply, 1/4 inch (6mm) is minimum of 3 ply, and 3/32 inch (2.4 mm) is 3-ply. Other hardwood plywood is sound grade, has a solid core and is suitable for semi-exposed or unexposed areas. All plywood shall be CARB Phase 1 compliant.

C. Hardboard used in drawer bottoms and unexposed backs, consists of super-refined wood fibers and chips, highly compressed into a hard, dense, 1/4 inch (6 mm) thick, homogeneous sheet, faced with wood grain pattern melamine on the exposed face. Physical properties: Average MOR is 5,000 lbs/sq inches (3.5 kgf/sq mm); density is 48 lbs/cu ft (0.6 kg/cu m); and MOE of 500,000 psi (350 kgf/sq mm). All hardboard shall be CARB Phase 1 compliant.

D. Stainless Steel: ASTM A 666 type 304, stainless steel, No. 4 satin finish unless noted otherwise.

## 2.4 FABRICATION

A. Units and configurations designated for accessibility by users shall comply with ATBCB ADAAG (ADA standards).

B. Design, material and construction of casework, and shelving shall comply with SEFA 8 performance and resistance standards.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for its intended use.

D. Base cabinets have a 2 1/4 inches (57 mm) by 1 inch (25 mm), solid hardwood horizontal front top frame member and 2 1/8 inches (54 mm) by 1 inch (25 mm), solid hardwood horizontal rear and side top frame members. Front intermediate rails are 3/4 inch (19 mm) by 2 1/2 inches (64 mm) solid wood. Back intermediate rails are furnished only when drawer separators are specified. Exposed exterior backs are 3/4 inch (19 mm) plywood. Cabinets with exposed interiors but unexposed exteriors have 1/4 inch (6 mm) plywood backs. Cabinets with unexposed interiors and exteriors have 1/4 inch (6 mm) thick hardboard with wood grained melamine face backs. Exposed end panels are 3/4 inch (19 mm) plywood. Unexposed end panels are 3/4 inch (19 mm) hardwood plywood. End panels with unexposed interior and unexposed exterior are 3/4 inch (19 mm) hardwood plywood. Bottom, shelves, and dividers in cabinets with exposed interiors are 3/4 inch (19 mm) plywood; with unexposed interiors is 3/4 inch (19 mm) hardwood plywood. If cabinet exceeds 36 inches (914 mm) in width, shelves shall be 1inch (25mm) thick. Exposed edges of front top horizontal frame and intermediate rail members; end panels, bottom, shelves, and dividers are edged with 1/8 inch (3 mm) solid wood. Drawer separators, furnished only when specified, are 1/4 inch (6 mm) thick hardboard with wood grained melamine face.

E. Cabinet construction is bored, doweled, dadoed, glued and screwed construction. Cabinets are enclosed without the use of common partitions. A full horizontal, mortise, tenon and glued, top frame is bored,

doweled, glued, and reinforced with six (6) screws into the cabinet. Intermediate front rails and bottom rear horizontal parting rails are provided as required. Separators, where specified, are let into routed intermediate rails. Backs are recessed and encapsulated into dadoed end panels then screwed into the top and bottom case members. A standard enclosed toe space, 2-1/4 inches (57 mm) by 4 inches (102 mm) high, is provided, with toe rail bored, doweled and glued to end panels; however, casework cabinets, when in a library assembly such as a circulation desk, will have an enclosed toe space 2-1/4 inches (57 mm) deep by 6 inches (152 mm) high. Shelves are supported on heavy-duty, laboratory grade, twin pin plastic shelf clips, which fit into two double rows of holes drilled 1-1/4 inches (32 mm) on centers, in the case end panels for maximum shelf adjustability.

F. Construction - Wall and Upper Cases: Wall and upper cases have a 1 inch (25 mm) plywood top and bottom panel. Adjustable shelves are 1 inch (25 mm) finished plywood in cases with exposed interiors and 1 inch (25 mm) hardwood plywood in cases with unexposed interiors. Backs are 1/4 inch (6 mm) finished plywood in cases with exposed interiors and 1/4 inch (6 mm) thick hardboard with melamine face in cases with unexposed interiors. End panels in cabinets with exposed interiors are 3/4 inch (19 mm) finished plywood; end panels in cabinets with unexposed interiors are 3/4 inch (19 mm) hardwood plywood. Exterior hanger rails are 4 inches (102 mm) by 3/4 inch (19 mm) hardwood plywood.

G. Construction - Tall Cases: Top panels in tall cases with exposed interiors are 1 inch (25 mm) hardwood plywood; tall cases with unexposed interiors have top panels of 1 inch (25 mm) plywood. Bottom panels in tall cases with exposed interiors are 3/4 inch (19 mm) hardwood plywood; and unexposed interiors have 3/4 inch (19 mm) plywood. Interiors, whether exposed or unexposed, are stain color matched to the exterior finish. Adjustable shelves are 1 inch (25 mm) thick hardwood plywood if exposed; 1 inch (25 mm) plywood if unexposed. Shelves are edged with 1/8 inch (3 mm) solid hardwood edging. Backs in tall cases with exposed interiors and exposed exteriors, are 1/4 inch (6 mm) hardwood plywood. Tall cases with unexposed interior or exterior backs have 1/4 inch (6 mm) hardboard melamine color stain matched to the interior. End panels in tall cases with exposed end panels have 3/4 inch (19 mm) hardwood plywood. End panels in cases with unexposed end panels have 3/4 inch (19 mm) plywood. All exposed edges of hardwood plywood components and plywood components are edged with 1/8 inch (3mm) solid hardwood edging. Tall cases have two exterior hardwood plywood cross rails, 4 inches by 3/4 inch (102 mm x 19 mm). Tall cases are rigidly constructed, integral units with the strongest, most advanced joinery methods utilized of bored, doweled, dadoed, glued and screwed construction. Each case is completely enclosed without the use of common partitions and has flush construction with overlapping doors to provide a dust resistant interior. The top panel is bored, doweled and glued into end panels; and the bottom panel is bored, doweled and glued into end panels and glued and screwed to the back. Additional back cross rails are provided as required. Backs are recessed and encapsulated into dadoed end panels and screwed to the top and bottom tall case members. An enclosed toe space 2-1/4 inch by 4 inches (57 mm by 102 mm) is provided with toe rail securely bored, doweled and glued to end panels and bottom panel. Adjustable shelves are supported on heavy-duty laboratory grade, twin pin plastic shelf clips, which fit into two rows of holes drilled 1-1/4 inches (32 mm) on centers in the end panels, for maximum shelf adjustability.

H. Drawer front is 3/4 inch (19 mm) thick. All squared edged styles drawer faces are screwed to the face of a full drawer box. Drawer box front, sides and back are 1/2 inch (12 mm), 9-ply laminated hardwood plywood, FSC PURE and CARS Phase 1 compliant. Drawer bottom is 1/4 inch (6 mm) thick hardboard with wood grained melamine face. All four corners of the drawer are dovetailed and glued. The top edges of drawer box are radiused. Drawer bottom is let in on four sides, and securely glued underneath with a continuous bead of glue around the perimeter of the drawer bottom. In cabinets 24 inches (610 mm) or less in width, drawers have one pull. In cabinets over 24 inches (610 mm) wide, drawers have two pulls.

I. Construction – Hinged Doors:

1. Hinged solid doors 48 inches (1219 mm) or less in height, 3/4 inch (19 mm) thick and overlap the opening on all sides. Doors have one pull. Door has two heavy duty, institutional type, and 5-knuckle hinges. Doors are secured by a friction roller catch and a metal strike plate.
2. Hinged solid doors, over 48 inches (1219 mm) in height, are 3/4 inch (19 mm) thick and overlap the opening on all sides. Single doors and right door of double doors have a latching handle. A three point latching system provides single doors and right door of double doors positive engagements at the top and bottom of the door with tapered aluminum rods, which engage plastic, strike plates and pull the door snug. The rods are 5/16-inch (8 mm) in diameter and move in nylon guides attached to the back of the door. The middle of the door is secured by a latch plate, which

engages the side of the case, or latches behind the left door on cases with double doors and securely hold the door shut. Right door of double doors lap over the machined integral astragal on left door in lipped styles; square edged styles have an applied astragal on the left door. Plastic laminate style doors have particleboard core, and no astragal. Doors have four hinges. On double doors left door is additionally secured with two friction roller catches with metal strike plates.

3. Hinged glazed doors 48 inches (1219 mm) or less in height are 3/4 inches (19 mm) by 3 inches (76 mm) with glass panel. Doors overlap opening 1/4 inch (6 mm) on all sides. The frame joints are bored, doweled and glued. The balance of the door is glass. Right door of double doors lap over the machined integral astragal on left door in lipped styles; square edged styles have an applied astragal on the left door. Plastic laminate style doors have no astragal. Doors have one pull, two hinges and are secured by friction roller catches with metal strike plate.
   a. Glass is tempered safety glass is specially heat-treated glass, 1/4 inch (6 mm) thick with a minimum of 88 percent clarity.
4. Hinged glazer doors, over 48 inches (1219 mm) in height, same construction with a 3/4 inch (19 mm) by 3 inch (76 mm) center cross frame member with glass panel. Single doors and right door of double doors have a latching handle. Left door of double doors has a fixed handle, which is the same size and finish as a latching handle. A three point latching system provides single doors and right door of double doors positive engagement at the top and bottom of the door with tapered aluminum rods, which engage plastic, strike plates and pulls the door snug. The rods are 5/16-inch (8 mm) in diameter and move in nylon guides attached to the back of the door. The middle of the door is secured by a latch plate, which engages the side of the case, or latches behind the left door on cases with double doors and securely hold the door shut. Right door of double doors lap over the machined integral astragal on left door in lipped styles; square edged styles have an applied astragal on the left door. Plastic laminate style doors have no astragal. Doors have four hinges. The left door of double doors is additionally secured by two friction roller catches and metal strike plates.

   Glass is tempered safety glass is specially heat-treated glass, 1/4 inch (6 mm) thick with a minimum of 88 percent clarity.

J. Construction Book Shelving: Book shelving top panels are 3/4 inch (19 mm) plywood with a 2-1/2 inch (63 mm) high front facia of solid hardwood. Bottom panels in cases with exposed interiors are 1 inch (25 mm) plywood. Adjustable shelves in are 1 inch (25 mm) plywood, with solid hardwood edge band on front and back edges. Backs are 1/4 inch (6 mm) plywood. End panels are 1 inch (25 mm) plywood. Exposed edges of end panels, dividers and shelves are edged with 1/4 inch (6 mm) solid wood. Intermediate panels are 1 inch (2 5mm) hardwood plywood. Book shelving is rigidly constructed with full top and bottom frames bolted to end and intermediate panels. Back panels are encapsulated in grooves in end panels and top panel. Book shelf units have adjustable shelves supported by heavy duty chrome plated steel pins recessed in shelf, 1-1/4 inch (32 mm) o.c.

## 2.5 FINISHES

A. Wood Cabinets: Exterior and interior surfaces of cabinets receive the full finishing process consisting of baked on: specified NGR stain, two coats of protective moisture resistant sealer and two applications of a topcoat of clear catalyzed chemical resistant conversion varnish.
   1. Interior Surfaces: The unexposed interior surfaces of cupboards, wall cases, upper cases, and tall cases must match exterior color and receive stain (color coat), a protective coat of moisture resistant sealer, and two applications of a clear, catalyzed, chemical resistant conversion varnish topcoat.
   2. Other Surfaces: Unexposed surfaces such as unexposed end panels, unexposed backs, drawer sides and drawer bottoms are processed through standard finishing steps and receive a baked on protective coat of moisture resistant sealer, baked on clear catalyzed chemical resistant conversion varnish, but no stain (color coat).
   3. Finish shall comply with SEFA-8 resistance standard acceptable levels for casework surfaces. An independent 3rd party testing facility's written certification must be provided to establish that final finish has no more than three, SEFA-8 "Level 3" conditions.

4. Any deviations from the specified finishing procedures will be considered defective Work and rejected by the Architect.

## 2.6 CABINET HARDWARE

A. Provide laboratory casework manufacturer's standard finish, commercial-quality, heavy-duty hardware complying with requirements indicated for each type.
B. Friction roller catch is zinc plated steel catch with a spring cushioned; polyethylene roller, and a metal strike plate. Screw mounted catches and strike plate have slotted holes for adjustability.
C. Shelf clips are made from clear polycarbonate and are laboratory standard grade. Magnetic catches are also acceptable. Clips have double, 3/16 inch (5 mm) diameter pins and are equipped with shelf lock hold down tabs for 3/4 inch (18 mm) or 1 inch (25 mm) thick shelves.

## 2.7 COUNTERTOPS

A. Rhearesin or equal, is 1 inch (25 mm) thick, molded from a modified epoxy resin. Exposed edges and corners are radiused, and a drip groove is provided under surface in areas where sinks are installed. Curb height per elevations, minimum 4 inches (102 mm) high.
   1. Color: Black.

## 2.8 ACCESSORIES

A. Plastic Tote Trays, as required by plan.
B. Wall Mounted Peg Board
   1. Provide phenolic resin back with removable polypropylene pegs.
   2. Provide stainless-steel drip troughs with drain outlet & tubing.

## 2.9 SERVICE FIXTURES

A. Provide service fixtures and fittings that comply with SEFA 7.
   1. Provide service fixtures and fittings that comply with recommendations of SEFA 7.
B. Epoxy resin sinks are drop-in style, non-glaring black, and specially modified epoxy resins, molded in one solid piece or optimum physical and chemical resistance. Inside corners are coved and the bottom is dished to the outlet. Outlets are polypropylene with 1 1/2 inch (38 mm) NPS threads. Sizes as noted on plans.
C. Service Fixtures: Triple chrome plating, heavy-duty construction for water, gas, or other services and specially designed for laboratory use. Hot and/or cold Water Faucets are cast from red brass with color-coded index handles. Faucets have serrated hose nozzles, unless specified otherwise. Goosenecks are rigid. Fixture outlets are tapped 3/8-inch (10 mm) I.P.S. for aerators, vacuum breakers, hose connections, or other accessories.
   1. Faucets with an integral vaccum breaker are required.
D. Vaccum Breakers: Watts NLF-9, or comparable, vacuum breakers are brass with polished chrome plating, screw-in type with stainless steel working parts, and durable rubber diaphragm and disc. Vacuum breaker is for hot or cold faucet and has a primary valve with a soft disc that seat against mating part. The secondary check valve utilizes a soft disc to metal seating. Breaker is tapped 3/8-inch (10 mm) N.P.T. Vacuum breaker is not intended for constant high pressures. Vacuum breakers shall be furnished where scheduled.

## 2.10 EQUIPMENT AND APPLIANCES

A. Flammable Liquid Storage Cabinets: Provide units that comply with requirements of NFPA 30.
   1. Metal.
B. Acid Cabinets as noted on plans.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.
   1. Walls and openings are plumb, straight and square.
   2. Concrete floors level within 1/8 inch (3 mm) level per 10 foot (3000 mm) run, non-accumulative, when tested with a straight edge in any one direction.
B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.2 COORDINATION

A. Laboratory equipment contractor shall furnish equipment to the building, setting in place, leveling and scribing to walls and floors. Furnish plumbing and electrical fixtures, including nipples and lock nuts needed to secure each fixture to the equipment.
B. Coordination with mechanical contractor who shall furnish, install and connect drain lines, service piping, vents, re-vents, in-line vacuum breakers, special plumbing fixtures, traps and tailpieces. Work to be completed through, under or along backs of working surfaces as required and complete final connection of services. Assemble, install and make final connections of service fixtures furnished by casework contractor, including service fixtures in fume hoods. Furnish, install and connect fume hood blowers, motors and all related ductwork. Furnish, install and connect service piping within fume hoods, including final connection.
C. Coordination with electrical contractor who shall furnish, install and connect electrical service lines, wire and conduit within the equipment, including reagent racks and fume hoods. Work to be completed through, under or along backs of working surfaces as required and complete final connection of services. Install and make final connections of electrical fixtures provided by casework installer, including electrical fixtures in fume hoods.

### 3.3 PREPARATION

A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### 3.4 INSTALLATION

A. Install casework in accordance with manufacturer's instructions.
   1. Installation of casework shall be plumb, level, true and straight, with no distortions.
   2. Use concealed shims as required.
   3. Where laboratory casework or equipment butts against other finished work, scribe and cut for an accurate fit.
   4. Lubricate operating hardware as recommended by the manufacturer.
B. Install countertop and edge surfaces in one plane with flush hairline seams. Locate seams where shown on Shop Drawings.
   1. Provide required holes and cutouts for service fittings as shown on Shop Drawings.

2. Seal unfinished edges and cutouts in plastic-laminate countertops.
3. Provide scribe moldings for closures at junctures of countertop, curb, and splash, with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent laboratory casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.
4. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Coordination with Mechanical, Plumbing and Electrical Contractors: Coordinate work of this Section with work of other Sections including but not limited to:
1. Water and laboratory gas service fittings, piping, electrical devices, and wiring.
2. Installation of fittings according to Shop Drawings and manufacturer's written instructions.
3. Setting bases and flanges of sink and countertop-mounted fittings in sealant recommended by manufacturer of sink or countertop material.
4. Anchorage of fittings, piping, and conduit to laboratory casework, unless otherwise indicated. Paragraph below is for mechanical and electrical equipment and systems.

## 3.5 PROTECTION

A. Cover installed casework and equipment with 4-mil polyethylene.
B. Protect installed products until completion of project.
C. Touch-up, repair or replace damaged products before substantial completion.
D. A qualified manufacturer representative shall demonstrate operation and maintenance procedures of the installed casework and equipment to the Owners personnel.

**END OF SECTION 12 35 53**

# SECTION 126600 - TELESCOPING STANDS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:

1. Wall-attached telescoping stands.

### 1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for telescoping stands.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Include wiring diagrams for electrically operated units.

C. Samples for Initial Selection: For each type of exposed finish required.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Decking: 3-inch- (75-mm-) square samples of finished material.
2. Metal Components: 3-inch- (75-mm-) square sample of each color and finish indicated.
3. Seating: 3-inch- (75-mm-) square sample of each seating material, color, and finish indicated.

E. Qualification Data: For Installer.

F. Operation and Maintenance Data: For telescoping stands to include in emergency, operation, and maintenance manuals.

### 1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Manufacturer's Engineering Responsibility: Preparation of data for telescoping stands, including Shop Drawings, and comprehensive engineering analysis by a qualified professional engineer.

C. Safety Standard: Provide telescoping stands that comply with requirements in NFPA 102.

D. Welding: Qualify procedures and personnel according to AWS D1.1 "Structural Welding Code - Steel" and AWS D1.3 "Structural Welding Code - Sheet Steel."

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. Accessibility Requirements: Provide telescoping stands that comply with requirements in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)".

G. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical telescoping stand as shown on Drawings.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

## 1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls, columns, and other construction that will interface with telescoping stands by field measurements before fabrication and indicate measurements on Shop Drawings.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: The design for telescoping stands is based on products of Irwin Seating Company. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Hussey Seating Company.
2. Interkal LLC.

2.2 MATERIALS

A. Wood:

1. Lumber: Kiln-dried, surfaced four sides; southern pine complying with SPIB's "Standard Grading Rules for Southern Pine Lumber" for B&B Finish (B and better) grade-of-finish requirements.
2. Plywood: APA grade trademarked, DOC PS 1.

B. Steel:

1. Structural Steel Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation.
3. Uncoated Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold-rolled commercial steel), or ASTM A 1011/A 1011M, Designation CS (hot-rolled commercial steel).
4. Tubing: ASTM A 500, cold formed; ASTM A 501, hot formed; or ASTM A 513, mechanical.

C. Extruded Aluminum: ASTM B 221 (ASTM B 221M), alloy as standard for manufacturer.

D. Polyethylene Plastic: High-density polyethylene; molded, color-pigmented, textured, impact-resistant, structural formulation.

2.3 TELESCOPING STANDS

A. Description: Operable systems of multiple-tiered seating on interconnected folding platforms that close, without being dismantled, into a nested stack for storing or moving. Stand units permit opening and closing of adjacent rows, allow individual and collective rows to be locked open for use, and close with vertical faces of upper skirts on the same vertical plane.

B. Wall-Attached Telescoping Stands: Rear of understructure permanently attaches to wall construction.

1. Basis-of-Design Product: VersaTract Telescopic Seating System as manufactured by Irwin Seating Company**.**
2. Operation: Automatic, integral power unit.
3. Friction drive: Drive system shall be furnished on each seating group to open and close the telescopic units. Each individual section shall include 2 friction drive systems integrated into the first moving row of understructure to achieve smooth and efficient operation. Operation of the seating shall be accomplished with the use of a walk along pendant control.
4. friction drive system shall include large 6 1/2" diameter friction rollers to develop tractive force adequate to open and close the system. Each roller to include non-marring 1/2" thick rubber covering.
5. Electrical motors for each section shall be heavy-duty and high efficiency gear reduction motors. The shaft diameter for the gear motor and rollers shall be a minimum of 1” and be connected by a 1” schedule 40 drive shaft.

6. All roller chain and sprockets used throughout the drive system shall be a minimum of #40 in size. Each drive unit shall be designed to include a safety shroud around the chain and sprocket for overall safety.
7. The power units shall develop tractive forces adequate to operate the seating units under normal conditions but inadequate to operate should significant obstacles be encountered.
8. Manufacturer shall provide all wiring from power source within bleacher seating including pendant control. Removable pendant control shall be handheld with forward and reverse button, plugging into a single receptacle. Electrical contractor will provide a power source behind each group of seating terminating in a surface mounted junction box above floor. Electrical contractor shall perform the connections to the seating equipment at the junction box. All electrical parts and wiring shall be installed in complete accord with the National Electric Code. U.L. Listing FHJU.E479554.
9. Coordinate power with elec. plans.

    a. Limit Switches: Automatically stop integral power system when telescoping stands reach fully opened or closed positions.
    b. Motion Monitor: Flashing light with self-contained warning horn, rated at 85 decibels (dB) at 10 feet (3 m), mounted under telescoping seating for audio and visual warning during integral power operation.
    c. Transformer: As required to coordinate current characteristics of motor and control station with building electrical system.

C. Row Spacing: 24”.

D. Row Rise: 10”

E. Elevated Front Row: In height indicated on Drawings.

F. Seats and Skirts:

1. Basis-of-Design Product: Irwin Seating Company, Infinity Seat Module
2. Material: Molded polyethylene plastic with contour seat.

    a. Colors: As selected by Architect from manufacturer's standard. Two (2) colors to be selected and text to be present when bleachers are retracted.

3. Seat Depth: 10”

G. Wheelchair-Accessible Seating: Recoverable wheel chair spaces shall be provided at the section joint location or section length as shown on plans. An integral support on row two shall be provided to eliminate structural damage to the understructure during the operation and use of the system.

1. Equip tiers adjacent to wheelchair-accessible seating with front rails as required by referenced safety standard.

H. Deck: Plywood.

1. Finish: High density Polyethylene textured overlay bonded to substrate with exterior glue.

2. Color: As selected by Architect from manufacturer's standard colors.

I. Risers: Steel sheet with manufacturer's standard rust-inhibiting coating or hot-dip galvanized finish.

J. Rails: Structural steel, finished with manufacturer's standard powder coat system.

1. Color: Black

K. Understructure: Structural steel.

1. Finish: Manufacturer's standard

L. Support Column Wheels: Nonmarring, soft, rubber-face wheel assembly under each support column.

1. Include wheels of size, number, and design required to support stands and operate smoothly without damaging the flooring surface, but not less than four per column or less than 3-1/2 inches (88.9 mm) in diameter and 1 inch (25.4 mm) wide.

M. Aisle Closures: Manufacturer's standard that produce flush vertical face at aisles when system is stored.

N. Fasteners: Vibration proof, in manufacturer's standard size and material.

O. Accessories:

1. Slip-resistant, abrasive tread surfaces at vertical aisles.
2. Intermediate aisle steps, fully enclosed, at each vertical aisle.
3. Transitional top step, fully enclosed, at each vertical aisle where last row of telescoping stands is adjacent to a cross aisle.
4. Removable front steps, fully enclosed, at each vertical aisle, that engage with front row to prevent accidental separation or movement and are equipped with a minimum of four skid-resistant feet.
5. Folding, nonremovable mid-aisle handrails located at centerline of each vertical aisle with seating on both sides.
6. End rails (guards) that are telescoping and self-storing.
7. Back rails (guards) along rear of units where required by referenced safety standard.
8. Front rails (guards) along front of units where required by referenced safety standard.
9. Removable, programming-support front rails to allow seating in upper rows while lower rows remain in the stored position.
10. Rear fillers including supports for closing openings between top row and rear wall of adjoining construction.
11. Gap fillers for closing openings between stand units or between stand units and adjoining construction.
12. End panels covering exposed ends of stands in stored position.
13. Back panels covering rear of freestanding units. Panels extend full height and width of unit.

14. Scorer's table 8' long x 18" wide. Table to include cantilevered folding legs designed to fit within the seating row without the need for mounting sockets, or for use on the floor in front of the stand.
15. Vinyl end curtains shall be provided to limit unauthorized access to the underside of the telescopic system. Curtain to be one piece design shaped to follow the angle of the telescopic unit in the open position and constructed of a sturdy vinyl material with sewn-in grommets for attachment. Color to be selected from manufacturer's standard selection.

## 2.4 FABRICATION

A. Fabricate understructure from structural steel members in size, spacing, and form required to support design loads specified in referenced safety standard.

B. Weld understructure to comply with applicable AWS standards.

C. Round corners and edges of components and exposed fasteners to reduce snagging and pinching hazards.

D. Form exposed sheet metal with flat, flush surfaces, level and true in line, and without cracking and grain separation.

E. Seating Supports: Fabricate supports to withstand, without damage to components, the forces imposed by use of stands without failure or other conditions that might impair the usefulness of seating units.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine areas where telescoping stands are to be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

A. Install telescoping stands to comply with referenced safety standard and manufacturer's written instructions.

## 3.3 ADJUSTING AND CLEANING

A. On completion of installation, lubricate, test, and adjust each telescoping stand unit so that it operates according to manufacturer's written operating instructions.

B. Clean installed telescoping stands on exposed and semiexposed surfaces. Touch up shop-applied finishes or replace components as required to restore damaged or soiled areas.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain telescoping stands. Refer to Division 01 Section "Demonstration and Training."

**END OF SECTION 12 66 00**

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# SECTION 21 05 00
# COMMON WORK RESULTS FOR FIRE SUPPRESSION

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Pipe, fittings, sleeves, escutcheons, seals, and connections for sprinkler systems.
B Expansion joints
C Expansion loops
D Grout
E Fire-Suppresion equipment and piping demolition where applicable
F Equipment Installation
G Painting and Finishing
H Concrete Bases
I Supports and Anchorage

### 1.02 REFERENCE STANDARDS

A ASME A112.18.1 - Plumbing Supply Fittings; 2018, with Errata.
B ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.
C ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.
D ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.
E ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2021.
F ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.
G ASME B16.9 - Factory-Made Wrought Buttwelding Fittings; 2018.
H ASME B16.11 - Forged Fittings, Socket-Welding and Threaded; 2021.
I ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
J ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
K ASME B16.25 - Buttwelding Ends; 2022.
L ASME B36.10M - Welded and Seamless Wrought Steel Pipe; 2022.
M ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).
N ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
O ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2021.
P ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.
Q ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2022.
R ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).
S ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2021.
T ASTM B32 - Standard Specification for Solder Metal; 2020.
U ASTM B75/B75M - Standard Specification for Seamless Copper Tube; 2020.
V ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
W ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2022a.
X ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023c.
Y ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).
Z AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.
AA AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2022).
BB AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2021.
CC AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2017.
DD AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2017, with Errata (2018).

EE AWWA C606 - Grooved and Shouldered Joints; 2022.
FF FM (AG) - FM Approval Guide; Current Edition.
GG ITS (DIR) - Directory of Listed Products; Current Edition.
HH NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
II UL (DIR) - Online Certifications Directory; Current Edition.

**1.03 SUBMITTALS**

A Refer to Division 01 Specifications for Submittal Procedures.
B Refer to Specification Section 21 13 00 FIRE SUPPRESSION SPRINKLER SYSTEMS for full Submittal Requirements.

**1.04 QUALITY ASSURANCE**

A Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
B Installer Qualifications: Company specializing in performing work of the type specified in this section.
1. Minimum five years experience.
C Comply with FM (AG), UL (DIR), and ITS (DIR) or Warnock Hersey requirements.
D Valves: Bear FM (AG), UL (DIR), and ITS (DIR) or Warnock Hersey product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.
E Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.
F Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

**1.05 DELIVERY, STORAGE, AND HANDLING**

A Deliver and store valves in shipping containers, with labeling in place.
B Provide temporary protective coating on cast iron and steel valves.
C Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

**1.06 WARRANTY**

A Correct defective Work within a five year period after Date of Substantial Completion.

**PART 2 PRODUCTS**

**2.01 FIRE PROTECTION SYSTEMS**

A Sprinkler Systems: Comply with NFPA 13.
B Welding Materials and Procedures: Comply with ASME BPVC-IX.

**2.02 ABOVE GROUND PIPING**

A Steel Pipe: ASTM A53 Schedule 40 or ASTM A795 Schedule 40, black.
1. Steel Fittings: ASME B16.5 steel flanges and fittings.
2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
3. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.
4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
5. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.

**2.03 PIPE SLEEVES**

A Vertical Piping:
1. Sleeve Length: 1 inch above finished floor.
2. Provide sealant for watertight joint.
3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.
B Plastic, Sheet Metal, or Moisture-Resistant Fiber: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.
C Pipe Passing Through Below Grade Exterior Walls:
1. Zinc-coated or cast-iron pipe.

2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

D Pipe Passing Through Quarry Tile, Terrazzo, or Ceramic Tile Floors:
1. Brass pipe.
2. Connect sleeve with floor plate.

E Pipe Passing Through Mechanical, Laundry, and Animal Room Floors above Basement:
1. Galvanized steel pipe or black iron pipe with asphalt coating.
2. Connect sleeve with floor plate except in mechanical rooms.

F Clearances:
1. Provide allowance for insulated piping.
2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.

**2.04 MANUFACTURED SLEEVE-SEAL SYSTEMS**

A Manufacturers:
1. The Metraflex Company
2. or approved equal.

B Modular/Mechanical Seal:
1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
2. Provide watertight seal between pipe and wall/casing opening.
3. Elastomer element size and material in accordance with manufacturer's recommendations.
4. Glass-reinforced plastic pressure endplates.

**2.05 ESCUTCHEONS**

A Manufacturers:
1. Fire Protection Products, Inc: www.fppi.com.com.
2. Tyco Fire Protection Products: www.tyco-fire.com.
3. Viking Group Inc: www.vikinggroupinc.com.
4. Victaulic Firelock.

B Material:
1. Fabricate from nonferrous metal.
2. Chrome-plated.
3. Metals and Finish: Comply with ASME A112.18.1.

C Construction:
1. One-piece for mounting on chrome-plated tubing or pipe and one-piece type elsewhere.
2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

**2.06 PIPE HANGERS AND SUPPORTS**

A Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.

B Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.

C Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

D Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

E Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

F Vertical Support: Steel riser clamp.

G Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

**2.07 EXPANSION LOOPS - HOSE AND BRAID**

A Manufacturers:
1. The Metraflex Company; FireLoop: www.metrafire.com/#sle.
2. or approved equal.

B Provide flexible loops with two flexible sections of hose and braid, two 90-degree elbows, and 180-degree return with support bracket and air release or drain plug.

C Provide flexible loops capable of movement in the x, y, and z planes. Flexible loops to impart no thrust loads to the building structure.

D Flexible Connectors: Flanged, braided type with wetted components of stainless steel, sized to match piping.
1. Maximum Allowable Working Pressure: 150 psig at 120 degrees F.

2. End Connections: Same as specified for pipe jointing.
3. Provide necessary accessories including, but not limited to, swivel joints.

**2.08 MECHANICAL COUPLINGS**

A Manufacturers:
1. Tyco Fire Protection Products: www.tyco-fire.com/#sle.
2. Victaulic Company; FireLock Style 009H: www.victaulic.com/#sle.
3. Anvil/Gruvlock.

B Rigid Mechanical Couplings for Grooved Joints:
1. Dimensions and Testing: Comply with AWWA C606.
2. Minimum Working Pressure: 300 psig.
3. Housing Material: Fabricate of ductile iron complying with ASTM A536.
4. Housing Coating: Factory applied orange enamel.
5. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
6. Bolts and Nuts: Hot-dipped-galvanized or zinc-electroplated steel.
7. Provide stops for direct stab installation without field assembly.

**PART 3 EXECUTION**

**3.01 PREPARATION**

A Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B Remove scale and foreign material, from inside and outside, before assembly.
C Prepare piping connections to equipment with flanges or unions.

**3.02 INSTALLATION**

A Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.
B Install standpipe piping, hangers, and supports in accordance with NFPA 14.
C Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
D Install piping to conserve building space, to not interfere with use of space and other work.
E Group piping whenever practical at common elevations.
F Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
G Inserts:
1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

H Pipe Hangers and Supports:
1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
2. Place hangers within 12 inches of each horizontal elbow.
3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
6. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

I Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
J Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.
K Structural Considerations:

1. Do not penetrate building structural members unless indicated.
2. Locate flexible expansion loops at or near the building seismic joint.

L Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
2. Aboveground Piping:
   a. Pack solid using mineral fiber complying with ASTM C592.
   b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
3. All Rated Openings: Caulk tight with firestopping material complying with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.
4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

M Manufactured Sleeve-Seal Systems:

1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a watertight seal.
6. Install in accordance with manufacturer's recommendations.

N Escutcheons:

1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
3. Attach plates at the underside only of suspended ceilings.
4. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.

O When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.

P Die-cut threaded joints with full-cut, standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.

## 3.03 CLEANING

A Upon completion of work, clean all parts of the installation.

B Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

C Spray-on Fireproofing overspray shall be removed from all piping, fittings, and all materials provided as part of the fire protection (sprinkler system) contract.

**END OF SECTION 21 05 00**

# SECTION 21 05 23
# GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Two-piece ball valves with indicators.
B Bronze butterfly valves with indicators.
C Iron butterfly valves with indicators.
D Check valves.
E Bronze OS&Y gate valves.
F Iron OS&Y gate valves.
G NRS gate valves.
H Indicator posts.
I Trim and drain valves.

### 1.02 RELATED REQUIREMENTS

A Section 21 05 00 - Common Work Results for Fire Suppression: Pipe and fittings.
B Section 21 05 48 - Vibration and Seismic Controls for Fire Suppression Piping and Equipment.
C Section 21 05 53 - Identification for Fire Suppression Piping and Equipment.
D Section 21 07 19 - Fire Suppression Piping Insulation.
E Section 21 12 00 - Fire-Suppression Standpipes.
F Section 21 13 00 - Fire-Suppression Sprinkler Systems.

### 1.03 ABBREVIATIONS AND ACRONYMS

A EPDM: Ethylene-propylene diene monomer.
B NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
C NRS: Non-rising stem.
D OS&Y: Outside screw and yoke.
E PTFE: Polytetrafluoroethylene.
F SBR: Styrene-butadiene rubber.

### 1.04 REFERENCE STANDARDS

A ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).
B ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.
C ASME B31.9 - Building Services Piping; 2020.
D ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.
E AWWA C508 - Swing-Check Valves for Waterworks Service, 2-In. Through 48-In. (50-mm Through 1,200-mm) NPS; 2017.
F AWWA C606 - Grooved and Shouldered Joints; 2022.
G FM (AG) - FM Approval Guide; Current Edition.
H NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
I NFPA 13R - Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies; 2022, with Errata.
J UL (DIR) - Online Certifications Directory; Current Edition.
K UL 262 - Gate Valves for Fire-Protection Service; Current Edition, Including All Revisions.
L UL 312 - Check Valves for Fire-Protection Service; Current Edition, Including All Revisions.
M UL 789 - Indicator Posts for Fire-Protection Service; Current Edition, Including All Revisions.
N UL 1091 - Standard for Butterfly Valves for Fire-Protection Service; Current Edition, Including All Revisions.

### 1.05 ADMINISTRATIVE REQUIREMENTS

A Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

**1.06 SUBMITTALS**

A See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

D Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

**1.07 QUALITY ASSURANCE**

A Manufacturer Qualifications:

1. Obtain valves for each valve type from single manufacturer.
2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

B Where listed products are specified, provide products listed, classified, and labeled by FM (AG), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for the purpose indicated.

C Welding Materials and Procedures: Comply with ASME BPVC-IX.

D Installer, Maintenance Contractor, and Testing Agency Qualifications:

1. Company specializing in performing the work of this section with minimum five years documented experience.
2. Trained and approved by manufacturer to design, install, test and maintain the equipment specified herein.
3. Complies with manufacturer's certification requirements.
4. Complies with manufacturer's insurance requirements.

**1.08 DELIVERY, STORAGE, AND HANDLING**

A Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and weld ends.
3. Set valves open to minimize exposure of functional surfaces.

B Use the following precautions during storage:

1. Maintain valve end protection and protect flanges and specialties from dirt.
    a. Provide temporary inlet and outlet caps.
    b. Maintain caps in place until installation.
2. Store valves in shipping containers and maintain in place until installation.
    a. Store valves indoors and maintain at higher than ambient dew point temperature.
    b. If outdoor storage is unavoidable, store valves off the ground in watertight enclosures.

C Use the following precautions for handling:

1. Use sling to handle large valves, rigged to avoid damage to exposed parts.
2. Do not use operating handles or stems as lifting or rigging points.

**PART 2 PRODUCTS**

**2.01 GENERAL REQUIREMENTS**

A UL Listed: Provide valves listed in UL (DIR) under following headings and bearing UL mark:

1. Main Level: HAMV - Fire Main Equipment.
    a. Level 1: HCBZ - Indicator Posts, Gate Valve.
    b. Level 1: HLOT - Valves.
    c. Level 3: HLUG - Ball Valves, System Control.
    d. Level 3: HLXS - Butterfly Valves.
    e. Level 3: HMER - Check Valves.
    f. Level 3: HMRZ - Gate Valves.
2. Main Level: VDGT - Sprinkler System & Water Spray System Devices.
    a. Level 1: VQGU - Valves, Trim, and Drain.

B FM Global Approved: Provide valves listed in FM (AG) Approval Guide under the following headings:

1. Automated Sprinkler Systems:
    a. Indicator posts.
    b. Valves:
        1) Gate valves.
        2) Single check valves.
        3) Miscellaneous valves.

C ASME Compliance:
1. ASME B16.1 for flanges on iron valves.
2. ASME B1.20.1 for threads on threaded-end valves.
3. ASME B31.9 for building services piping valves.

D Comply with AWWA C606 for grooved-end connections.

E Comply with NFPA 20, NFPA 13R, and ____ for valves.

F Valve Pressure Ratings: Not less than minimum pressure rating indicated or higher as required.

G Valve Sizes: Same as upstream piping unless otherwise indicated.

H Valve Actuator Types:
1. Worm-gear actuator with handwheel for quarter-turn valves, except trim and drain valves.
2. Handwheel: For other than quarter-turn trim and drain valves.
3. Hand-lever: For quarter-turn trim and drain valves 2 NPS and smaller.

## 2.02 TWO-PIECE BALL VALVES WITH INDICATORS

A Manufacturers:
1. Victaulic Co. of America
2. Tyco
3. Nibco

B UL 1091, except with ball instead of disc and FM (AG) standard listing for indicating valves (butterfly or ball type), Class Number 1112.

C Description:
1. Minimum Pressure Rating: 175 psig.
2. Body Design: Two piece.
3. Body Material: Forged brass or bronze.
4. Port Size: Full or standard.
5. Seat: PTFE.
6. Stem: Bronze or stainless steel.
7. Ball: Chrome-plated brass.
8. Actuator: Worm gear or traveling nut.
9. Supervisory Switch: Internal or external.
10. End Connections for Valves 1 NPS through 2 NPS: Threaded ends or Grooved where available.
11. End Connections for Valves 2-1/2 NPS: Grooved ends.

## 2.03 BRONZE BUTTERFLY VALVES WITH INDICATORS

A Manufacturers:
1. Victaulic Co. of America.
2. Tyco.
3. Nibco

B UL 1091 and FM (AG) standard listing for indicating valves, (butterfly or ball type), Class Number 1112.

C Minimum Pressure Rating: 175 psig.

D Body Material: Bronze.

E Seat: EPDM.

F Stem: Bronze or stainless steel.

G Disc: Bronze with EPDM coating.

H Actuator: Worm gear or traveling nut.

I Supervisory Switch: Internal or external.

J End Connections for Valves 1 NPS through 2 NPS: Threaded ends or Grooved where available.

K End Connections for Valves 2-1/2 NPS: Grooved ends.

**2.04 IRON BUTTERFLY VALVES WITH INDICATORS**

A Manufacturers:
1. Victaulic Co. of America.
2. Nibco
3. Tyco

B UL 1091 and FM (AG) standard listing for indicating valves (butterfly or ball type), Class Number 112.

C Minimum Pressure Rating: 175 psig.

D Body Material: Cast or ductile iron with nylon, EPDM, epoxy, polyamide, or approved coating.

E Seat: EPDM.

F Stem: Stainless steel.

G Disc: Ductile iron, nickel plated.

H Actuator: Worm gear or traveling nut.

I Supervisory Switch: Internal or external.

J Body Design: Grooved-end connections.

**2.05 CHECK VALVES**

A Manufacturers:
1. Victaulic Co. of America.
2. Nibco
3. Tyco

B UL 312 and FM (AG) standard listing for check valves, Class Number 1045.

C Minimum Pressure Rating: 175 psig.

D Type: Center guided check valve.

E Body Material: Cast iron, ductile iron.

F Center guided check with elastomeric seal.

G Hinge Spring: Stainless steel.

H End Connections: Flanged, grooved, or threaded.

**2.06 BRONZE OS&Y GATE VALVES**

A Manufacturers:
1. Victaulic Co. of America.
2. Tyco.
3. Nibco

B UL 262 and FM (AG) standard listing for fire-service water control valves (OS&Y and NRS-type gate valves).

C Minimum Pressure Rating: 175 psig.

D Body and Bonnet Material: Bronze or brass.

E Wedge: One-piece bronze or brass.

F Wedge Seat: Bronze.

G Stem: Bronze or brass.

H Packing: Non-asbestos PTFE.

I Supervisory Switch: External.

J End Connections: Threaded.

**2.07 IRON OS&Y GATE VALVES**

A Manufacturers:
1. Victaulic Co. of America.
2. Nibco
3. Tyco

B UL 262 and FM (AG) standard listing for fire-service water control valves (OS&Y and NRS-type gate valves).

C Minimum Pressure Rating: 175 psig.

D Body and Bonnet Material: Cast or ductile iron.

E Wedge: Cast or ductile iron, or bronze with elastomeric coating.
F Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
G Stem: Brass or bronze.
H Packing: Non-asbestos PTFE.
I Supervisory Switch: External.
J End Connections: Flanged.

**2.08 NRS GATE VALVES**

A Manufacturers:
1. Victaulic Co. of America.
2. Tyco.
3. Nibco

B UL 262 and FM (AG) standard listing for fire-service water control valves (OS&Y and NRS-type gate valves).
C Minimum Pressure Rating: 175 psig.
D Body and Bonnet Material: Cast or ductile iron.
E Wedge: Cast or ductile iron with elastomeric coating.
F Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
G Stem: Brass or bronze.
H Packing: Non-asbestos PTFE.
I Supervisory Switch: External.
J End Connections: Flanged.

**2.09 INDICATOR POSTS**

A Manufacturers:
1. Victaulic Co. of America.
2. Tyco.
3. Nibco
4. Viking

B UL 789 and FM (AG) standard listing for indicator posts.
C Type: Underground.
D Base Barrel Material: Cast or ductile iron.
E Extension Barrel for Adjustable Length Indicator Posts: Cast or ductile iron.
F Cap: Cast or ductile iron.
G Operation: Wrench.

**2.10 TRIM AND DRAIN VALVES**

A Ball Valves:
1. Manufacturers:
   a. Victaulic Co. of America.
   b. Tyco.
   c. Viking.
   d. Nibco
2. Description:
   a. Pressure Rating: 175 psig.
   b. Body Design: Two piece.
   c. Body Material: Forged brass or bronze.
   d. Port Size: Full or standard.
   e. Seat: PTFE.
   f. Stem: Bronze or stainless steel.
   g. Ball: Chrome-plated brass.
   h. Actuator: Hand-lever.
   i. End Connections for Valves 1 NPS through 2-1/2 NPS: Threaded ends or Grooved where available.

j. End Connections for Valves 1-1/4 NPS and 2-1/2 NPS: Grooved ends.

B Angle Valves:
1. Manufacturers:
a. Victaulic Co. of America.
b. Tyco.
c. Viking.
d. Nibco
2. Description:
a. Pressure Rating: 175 psig.
b. Body Material: Brass or bronze.
c. Ends: Threaded.
d. Stem: Bronze.
e. Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron, bronze, or aluminum.

C Globe Valves:
1. Manufacturers:
a. Victaulic Co. of America.
b. Tyco.
c. Viking.
d. Nibco
2. Description:
a. Pressure Rating: 175 psig.
b. Body Material: Bronze with integral seat and screw-in bonnet.
c. Ends: Threaded.
d. Stem: Bronze.
e. Disc Holder and Nut: Bronze.
f. Disc Seat: Nitrile.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A Confirm valve interior to be free of foreign matter and corrosion.
B Remove packing materials.
C Examine guides and seats by operating valves from the fully open position to the fully closed position.
D Examine valve threads and mating pipe for form and cleanliness.
E Examine mating flange faces for conditions that might cause leakage.
1. Check bolting for proper size, length, and material.
2. Verify gasket for size, defects, damage, and suitable material composition for service.
3. Replace all defective valves with new valves.

### 3.02 INSTALLATION

A Comply with specific valve installation requirements and application in the following Sections:
1. Section 21 12 00 for application of valves in fire-suppression standpipes.
2. Section 21 13 00 for application of valves in wet and dry pipe, fire-suppression sprinkler systems.
3. Section 21 13 39 for application of valves in foam-water, fire-suppression sprinkler systems.

B Install listed fire protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections.
1. Install permanent identification signs indicating portion of system controlled by each valve.

C Install check valve in water supply connections and backflow preventer at potable water supply connections.
D Valves with threaded connections to have unions at equipment arranged for easy access, service, maintenance, and equipment removal without system shutdown.

E Valves in horizontal piping installed with stem at or above the pipe center.

F Position valves to allow full stem movement.

G Install valve tags. Comply with Section 21 05 53 requirements for valve tags, schedules, and signs on surfaces concealing valves; and the appropriate NFPA standard applying to the piping system in which valves are installed.

**END OF SECTION 21 05 23**

# SECTION 21 05 53
# IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Nameplates.
B Tags.
C Stencils.
D Pipe markers.
E Ceiling tacks.

### 1.02 REFERENCE STANDARDS

A ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.
B ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

### 1.03 SUBMITTALS

A List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
B Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
C Product Data: Provide manufacturers catalog literature for each product required.
D Project Record Documents: Record actual locations of tagged valves.

## PART 2 PRODUCTS

### 2.01 IDENTIFICATION APPLICATIONS

A Automatic Controls: Tags.
B Control Panels: Nameplates.
C Instrumentation: Tags.
D Major Control Components: Nameplates.
E Piping: Tags.
F Pumps: Nameplates.
G Relays: Tags.
H Small-sized Equipment: Tags.
I Thermostats: Nameplates.
J Valves: Nameplates and ceiling tacks where above lay-in ceilings. Note: Identification Signs shall be provided at each valve to indicate its function and what it controls. (NFPA 13:8.16.1.1.8)

### 2.02 NAMEPLATES

A Manufacturers:
1. Brimar Industries, Inc: www.pipemarker.com/#sle.
2. Kolbi Pipe Marker Company: www.kolbipipemarkers.com/#sle.
3. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.

B Description: Laminated three-layer plastic with engraved letters.
1. Letter Color: White.
2. Letter Height: 1/4 inch.
3. Background Color: Black.
4. Thickness: 1/8 inch.
5. Plastic: Comply with ASTM D709.

### 2.03 TAGS

A Manufacturers:
1. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com/#sle.
2. Brady Corporation: www.bradycorp.com/#sle.
3. Brimar Industries, Inc: www.pipemarker.com/#sle.
4. Kolbi Pipe Marker Company: www.kolbipipemarkers.com/#sle.
5. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.

B Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
C Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

D Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

**2.04 STENCILS**

A Manufacturers:
1. Brady Corporation: www.bradycorp.com/#sle.
2. Kolbi Pipe Marker Company: www.kolbipipemarkers.com/#sle.
3. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.

B Stencils: With clean cut symbols and letters of following size:
1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.
4. 8 to 10 inch Outside Diameter of Insulation or Pipe: 24 inch long color field, 2-1/2 inch high letters.
5. Over 10 inch Outside Diameter of Insulation or Pipe: 32 inch long color field, 3-1/2 inch high letters.
6. Equipment: 2-1/2 inch high letters.

C Paint for Stencils: As specified in Section 09 91 23, semi-gloss enamel, colors complying with ASME A13.1.

**2.05 PIPE MARKERS**

A Manufacturers:
1. Brady Corporation: www.bradycorp.com/#sle.
2. Brimar Industries, Inc: www.pipemarker.com/#sle.
3. Kolbi Pipe Marker Company: www.kolbipipemarkers.com/#sle.
4. Seton Identification Products, a Tricor Company: www.seton.com/#sle.

B Color: Comply with ASME A13.1.

C Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

E Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

F Color code as follows:
1. Fire Quenching Fluids: Red with white letters.

**2.06 CEILING TACKS**

A Manufacturers:
1. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
2. Seton Identification Products, a Tricor Company;.
3. Kolbi Pipe Marker Company;.

B Description: Steel with 3/4 inch diameter color coded head.

C Color code as follows:
1. Sprinkler Valves: Red.

**PART 3 EXECUTION**

**3.01 PREPARATION**

A Degrease and clean surfaces to receive adhesive for identification materials.

B Prepare surfaces in accordance with Section 09 91 23 for stencil painting.

**3.02 INSTALLATION**

A Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B Install tags with corrosion resistant chain.

C Apply stencil painting in accordance with Section 09 91 23.

D Install plastic pipe markers in accordance with manufacturer's instructions.

E Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

F Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G Use tags on piping 3/4 inch diameter and smaller.
1. Identify service, flow direction, and pressure.

2. Install in clear view and align with axis of piping.
3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

H Locate ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

**END OF SECTION 21 05 53**

# SECTION 21 07 19
# FIRE SUPPRESSION PIPING INSULATION

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Piping insulation.

B Jacketing and accessories.

### 1.02 RELATED REQUIREMENTS

A Section 07 84 00 - Firestopping.

### 1.03 REFERENCE STANDARDS

A ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.

B ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

C ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023c.

D UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

## PART 2 PRODUCTS

### 2.01 REGULATORY REQUIREMENTS

A Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

**END OF SECTION 21 07 19**

**SECTION 21 11 00**

**FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING**

**PART 2 PRODUCTS**

**END OF SECTION 21 11 00**

# SECTION 21 13 00
# FIRE-SUPPRESSION SPRINKLER SYSTEMS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Wet-pipe sprinkler system.
B Dry-pipe sprinkler system.
C Deluge sprinkler system.
D Preaction sprinkler system.
E System design, installation, and certification.
F Fire department connections.

### 1.02 REFERENCE STANDARDS

A FM (AG) - FM Approval Guide; Current Edition.
B ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2018, with Editorial Revision (2020).
C ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry; 2018, with Editorial Revision (2020).
D ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2017, with Editorial Revision (2020).
E ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2023.
F ITS (DIR) - Directory of Listed Products; Current Edition.
G NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
H NFPA 1963 - Standard for Fire Hose Connections; 2019.
I UL (DIR) - Online Certifications Directory; Current Edition.
J UL 405 - Standard for Safety Fire Department Connection Devices; Current Edition, Including All Revisions.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A Preinstallation Meeting: Convene minimum one week before starting work of this section.

### 1.04 SUBMITTALS

A Fire Protection Contractor shall acquire or perform their own Flow Test meeting the requirements of NFPA 291 and submit for review with the Submittals required by this section.
B Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
C Provide Hydraulic Calculations, including safety factors where applicable, and per NFPA 13, supporting fire protection sprinkler system design illustrated in Shop Drawings
D Shop Drawings:
1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components, and accessories. Indicate system controls.
3. Submit shop drawings to Authorities Having Jurisdiction for approval. Submit proof of approval to Architect. Note: Confirm process with Owner Rep and Architect prior to submittal to AHJ.
E Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.
F Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
G Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Extra Sprinklers: Type and size matching those installed in quantity required by referenced NFPA design and installation standard.
2. Sprinkler Wrenches: For each sprinkler type.

H Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

**1.05 QUALITY ASSURANCE**

A Maintain one copy of referenced design and installation standard on site.

B Comply with FM (AG) requirements.

C Designer Qualifications: Design system under direct supervision of a minimum Nicet Level III Wet Sprinkler System designer experienced in design of this type of work and licensed in the State in which the Project is located.

D Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

E Installer Qualifications: Company specializing in performing the work of this section with minimum _____ years experience and approved by manufacturer.

F Equipment and Components: Provide products that bear FM (AG) label or marking.

G Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

**1.06 DELIVERY, STORAGE, AND HANDLING**

A Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

A Sprinklers, Valves, and Equipment:

1. Tyco Fire Protection Products: www.tyco-fire.com/#sle.
2. Viking Corporation: www.vikinggroupinc.com/#sle.
3. Globe.
4. Reliable

**2.02 SPRINKLER SYSTEM**

A Sprinkler System: Provide coverage for entire building.

B Occupancy: Light hazard; comply with NFPA 13.

C Water Supply: Determine volume and pressure from water flow test data.

1. Revise design when updated and/or current test data is available prior to submittals.

D Provide fire department connections where indicated.

E Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

F Pipe Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:

1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.

**2.03 SPRINKLERS**

A Suspended Ceiling Type: Semi-recessed pendant type with matching push on escutcheon plate.

1. Response Type: Quick.
2. Coverage Type: Standard.
3. Finish: Enamel, color WHITE .
4. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

B Exposed Area Type: Pendant type with guard.

1. Response Type: Quick.
2. Coverage Type: Standard.
3. Finish: Brass.
4. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

C Sidewall Type: Semi-recessed horizontal sidewall type with matching push on escutcheon plate.

1. Response Type: Quick.
2. Coverage Type: Standard.

3. Finish: Brass.
4. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

D Dry Sprinklers: Concealed pendant type with matching push on escutcheon plate.
1. Response Type: Quick.
2. Coverage Type: Standard.
3. Finish: Brass.
4. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

E Storage Sprinklers: Pendant type with guard.
1. Response Type: Standard.
2. Coverage Type: Standard.
3. Finish: Chrome plated.
4. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

F Guards: Finish to match sprinkler finish.

G Spray Nozzles: Brass with solid cone discharge, 30 degrees of arc with blow-off dust cap.
1. Finish: Brass.

H Flexible Drop System: Stainless steel, multiple use, open gate type.
1. Application: Use to properly locate sprinkler heads.
2. Include all supports and bracing.
3. Provide braided type tube as required for the application.
4. Manufacturers:
   a. Victaulic Company; Vic-Flex: www.victaulic.com/#sle.
   b. FM and UL listed approved equals.

## 2.04 PIPING SPECIALTIES

A Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber-faced clapper to automatically actuate water motor alarm, pressure retard chamber and variable pressure trim with the following additional capabilities and features:
1. Activate electric alarm.
2. Test and drain valve.
3. Replaceable internal components without removing valve from installed position.
4. Manufacturers:
   a. Victaulic Company; Series 751 with Series 760 motor alarm: www.victaulic.com/#sle.

B Backflow Preventer: Reduced pressure principle valve assembly backflow preventer with drain and OS & Y gate valve on each end.
1. Manufacturers:

C Test Connections:
1. Inspector's Test Connection for Preaction Systems:
   a. Provide test connections approximately 6 ft above floor for each or portion of each sprinkler system equipped with an alarm device, located at the most remote part of each system.
   b. Route test connection to an open-site drain location, excluding janitor sinks, accepting full flow without negative consequences.
   c. Supply discharge orifice with same size as corresponding sprinkler orifice.
2. Backflow Preventer Test Connection:
   a. Provide downstream of the backflow prevention assembly, listed hose valves with 2.5 inch National Standard male hose threads with cap and chain.
   b. Furnish one valve for each 250 gpm of system demand or fraction thereof.
   c. Provide permanent sign reading "Test Valve" in accordance with Section 22 05 53.

D Electric Alarm: Electrically operated chrome plated gong with pressure alarm switch.

E Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.

F Fire Department Connections:
1. ***Type: Exposed, projected wall mount made of corrosion resistant metal complying with UL 405. Equip FDC with 5-Inch Storz Fitting Connections for Compliance with Wilson Fire Department***

***Requirements. Verify with Local AHJ prior to fabricating pump package.***

a. Inlets: Two way, 2-1/2 inch swivel fittings, internal threaded. Thread size and inlets according to NFPA 1963 or Authority Having Jurisdiction. Brass caps with gaskets, chains, and lugs.
b. Outlet: Back with pipe threads, 4 NPS.
c. Rated Working Pressure: 175 psi.
d. Finish: Chrome.
e. Sleeve: Brass, 18 inches height.
f. Signage: Raised or engraved lettering 1 inch minimum indicating system type.

## PART 3 EXECUTION

### 3.01 INSTALLATION

A Install in accordance with referenced NFPA design and installation standard.
B Install equipment in accordance with manufacturer's instructions.
C Install buried shut-off valves in valve box. Provide post indicator.
D Provide approved double check valve assembly at sprinkler system water source connection.
E Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.
F Locate outside alarm gong on building wall as indicated.
G Place pipe runs to minimize obstruction to other work.
H Place piping in concealed spaces above finished ceilings.
I Center sprinklers in two directions in ceiling tile and provide piping offsets as required.
J Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
K Install and connect to fire pump system in accordance with Section 21 30 00.
L Flush entire piping system of foreign matter.
M Install guards on sprinklers where indicated.
N Hydrostatically test entire system.
O Require test be witnessed by Fire Marshal.

### 3.02 INTERFACE WITH OTHER PRODUCTS

A Ensure required devices are installed and connected as required to fire alarm system.

**END OF SECTION 21 13 00**

# SECTION 21 30 00
# FIRE PUMPS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Fire pump package, including fire pump, diesel engine drive, controllers, enclosure, and accessories.
B Electric jockey pump.
C System maintenance.

### 1.02 REFERENCE STANDARDS

A FM (AG) - FM Approval Guide; Current Edition.
B ITS (DIR) - Directory of Listed Products; Current Edition.
C NEMA MG 1 - Motors and Generators; 2021.
D NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
E NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
F NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection; 2022.
G NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines; 2021.
H UL (DIR) - Online Certifications Directory; Current Edition.
I UL 448 - Centrifugal Stationary Pumps for Fire-Protection Service; Current Edition, Including All Revisions.
J UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.
K UL 1247 - Diesel Engines for Driving Centrifugal Fire Pumps; Current Edition, Including All Revisions.
L UL 1478 - Fire Pump Relief Valves; Current Edition, Including All Revisions.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A Preinstallation Meeting: Convene four weeks before starting work of this section.

### 1.04 SUBMITTALS

A Product Data: Provide manufacturers literature including general assembly, pump curves showing performance characteristics with pump and system, operating point indicated, NPSH curve, controls, wiring diagrams, and service connections.
B ***Shop Drawings: Indicate layout, general assembly, components, dimensions, weights, clearances, and methods of assembly for both Fire Pump and/or Pre-packaged Skid-Mounted Fire Pump and Enclosure where required.***
C Certificates: Certify that fire pumps meet or exceed specified requirements at specified operating conditions and that the installation complies with regulatory requirements. Submit summary and results of shop tests performed in accordance with NFPA 20
D Test Reports: Indicate results of hydrostatic test and field acceptance tests.
E Manufacturer's Instructions: Indicate support details, connection requirements, for fire pump system.
F Designer's Qualification Statement.
G Manufacturer's Qualification Statement.
H Installer's Qualification Statement.
I Maintenance Contract.
J Operation Data: Include manufacturers instructions, start-up data, trouble-shooting check lists, for pumps, drivers, and controllers.
K Maintenance Data: Include manufacturers literature, cleaning procedures, replacement parts lists, and repair data for pumps, drivers and controllers.
L Project Record Documents: Record actual locations of components and accessories.
M Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Extra Pump Gaskets/Screens/Seals: One set for each different pump model.

### 1.05 QUALITY ASSURANCE

A Comply with NFPA 13 and NFPA 20; where requirements differ comply with the most stringent.
B Maintain on site at all times one copy of each design and installation standard referenced.
C Design fire pump system under direct supervision of a minimum Nicet Level III Wet Sprinkler System designer experienced in design of this work and licensed at the State in which the Project is located.

D Equipment and Components: Bearing FM (AG) label or marking.

E Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

F Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

G Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years experience.

H Provide certificate of compliance from authority have jurisdiction indicating approval of field acceptance tests.

**1.06 DELIVERY, STORAGE, AND HANDLING**

A Deliver fire pumps and components in factory packing. Comply with manufacturer's rigging and installation instructions.

B Protect fire pumps and components from physical damage including effects of weather, water, and construction debris.

C Provide temporary inlet and outlet caps, and maintain in place until installation.

**PART 2 PRODUCTS**

**2.01 FIRE PUMPS**

A Manufacturers:

1. AC Fire Pump, a xylem brand: www.acfirepump.com/#sle.
2. Patterson Pump Company, a Gorman-Rupp Company: www.pattersonpumps.com/#sle.
3. Peerless Pump Company: www.peerlesspump.com/#sle.
4. SPP Pumps, Inc: www.spppumps.com/#sle.

B Fire Pumps: Vertical in-line type; UL 448 and UL 778; single stage, close coupled, radially or horizontally split casing, for in-line mounting, for 250 psi.

1. Casing: Cast or ductile iron, with suction and discharge gauge port, casing wear ring, seal flush connection, drain plug, flanged suction and discharge.
2. Impeller: Bronze, fully enclosed, keyed directly to motor shaft.
3. Shaft: Solid alloy steel with bronze sleeve.
4. Seal: Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 230 degrees F maximum continuous operating temperature.

C Accessories:

1. Eccentric suction reducer and OS&Y gate or butterfly valve on suction side of pump.
2. Concentric increaser and check valve in pump discharge and OS&Y gate or butterfly valve on system side of check valve.
3. Fire pump bypass fitted with OS&Y gate or butterfly valves and check valve.
4. Main relief valve, UL 1478 and enclosed type waste cone.
5. Suction pressure gauge, 4-1/2 inch diameter dial with snubber, valve cock and lever handle.
6. Discharge pressure gauge mounted on board attached to pump, with snubber, valve cock and lever handle.
7. 3/4 inch casing relief valve.
8. Float operated 3/4 inch automatic air release valve.
9. Hose valve manifold with 2-1/2 inch hose gate valves with caps and chains.
10. Flow metering system for closed loop testing.

**2.02 DIESEL ENGINE DRIVE:**

A Diesel Engine: Comply with requirements of NFPA 37 and UL 1247; automatic operation with overspeed/overcrank switch and drive, two contactor switches, low oil pressure and high water temperature warning switches, and fuel shut-off solenoid, with wiring terminating in junction box.

B Cooling Water System: Closed system with cooling water supply to heat exchanger from fire pump discharge. Include four manual shut-off valves (including by-pass line), two strainers, pressure regulating valve, automatic solenoid valve and pressure gauge.

C Storage Batteries: Dual lead acid batteries with cables and battery racks.

D Fuel System: above ground storage tank, fill pipe and cap, manual shut-off valve, flame arrestor, oil level gauge, braided bronze flexible connectors, seamless type L copper tubing with flared joints. Fill tank at completion.

E Engine Controller: Automatic; drive enclosed in floor mounted 14 gage, 0.0747 inch steel housing, UL (DIR) listed and labelled.

1. Controller: Function to automatically start fire pump from water pressure control switch or test switch.
2. Stop Push Button: To manually stop engine.
3. Automatic Conditions: Controller shall alternate batteries automatically on each 15 second cranking cycle. Alarm if engine not started after six attempts.
4. Battery Charger: Dual, built-in, to recharge both batteries within 24 hour period, with automatic overload protection (current limiting), individual voltmeters and ammeters for each battery.

**2.03 PRESSURE BOOSTER (JOCKEY) PUMP**

A Manufacturers:

1. Armstrong Pumps Inc: www.armstrongpumps.com/#sle.
2. Grundfos: www.us.grundfos.com/#sle.
3. Talco Fire Systems: www.talcofire.com/#sle.
4. AC Fire Pump (Xylem).

B Electrically operated, horizontal turbine type with standard open drip-proof horizontal motor.

C Control by automatic jockey pump controller with full voltage starter and minimum run timer to start pump on pressure drop in system and stay in operation for minimum period of time. Fire pump shall start automatically on further pressure drop or on jockey pump failure.

**2.04 *PRE-PACKAGED SKID-MOUNTED FIRE PUMP ENCLOSURES***

A ***Provide Fire Pump Enclosure by same manufacturer of Fire Pump or by company contracted to Fire Pump Manufacturer for construction of enclosures for Fire Pump Manufacturer - Contractor Built Enclosures or Enclosures purchased separately from Fire Pump will not be allowed.***

B ***Fire Pump and Enclosure manufacturers and products must be NFPA, FM, and UL Listed and/or approved.***

C ***System shall be constructed of pre-engineered components factory mounted to steel skid base and all piping shall be hydrostatically tested prior to shipping.***

D ***Enclosure Floor shall be constructed of Steel Framework components of 12, 14, and 16 Gauge Steel minimum, protected from the elements by Galvanizing or approved equal finishing method, and designed for the loads of the packaged pump and enclosure elements.***

E ***Provide Slip Resistant Steel Deck Plate Flooring***

F ***Enclosure walls shall be min. 22 gauge steel liner panels with concealed fasteners and min. 3-1/2" R-14 High Density Insulation with a min. 1" thermal break of Insulating Blanket Insulation. Provide color selection materials, including custom colors available, for Architect's review and selection.***

G ***Enclosure Roof shall be of Solid Web Steel Roof Trusses and steel purlins protected from the elements by Galvanizing or approved equal finishing method, and 18 gauge ribbed steel roofing panels with single slope .***

H ***Enclosure Roof, Ceiling, and exterior and interior faces of wall panels shall be finished with Factory Kynar 500 baked on Polyester Resin Finish or approved equal finish. Provide color selection materials, including custom colors available, for Architect's review and selection.***

I ***Enclosure shall be factory pre-wired to accept a single external electrical connection in the field and meet all NFPA and NEC and Electrical Building Code requirements.***

J ***Enclosure shall come equipped with factory installed exhaust fan and heater as required.***

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A Install in accordance with NFPA 20.

B Install diesel engine drive in accordance with NFPA 37.

C Provide access space around pumps for service; no less than minimum as recommended by manufacturer.

D Install piping in accordance with Section 21 05 00. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For

base mounted pumps, provide supports under elbows on pump suction and discharge.

E Provide drains for bases and seals, piped to and discharging into floor drains.

F Mount unit on vibration isolators. Refer to Section 21 05 48.

G Provide piping for fuel supply and return connected to engine drive. Provide piping to and from exhaust silencer with thimble at wall or roof penetrations. Refer to Section 23 11 13.

H Insulate piping associated with pump, pump casing and exhaust silencer. Refer to Section 21 07 16 and Section 21 07 19.

I Provide for connection to electrical service. Refer to Section 26 05 83.

J Lubricate pumps before start-up.

K Check, align, and certify pumps by qualified installer prior to start-up.

**3.02 FIELD QUALITY CONTROL**

A Perform field inspection and testing in accordance with Section 01 40 00 - Quality Requirements.

B Perform hydrostatic tests, flushing, and field acceptance tests as specified in NFPA 20.

C Perform field acceptance tests in the presence of Fire Marshal.

**3.03 CLOSEOUT ACTIVITIES**

A Demonstration:

B Demonstrate automatic operation of system including verification of pressure switch set points to Owner.

C Use operation and maintenance data as reference during demonstration.

D Briefly describe function, operation, and maintenance of each component.

E Conduct walking tour of project.

F Training: Train Owner's personnel on operation and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.
3. Instructor: Manufacturer's training personnel.
4. Location: At project site.

**3.04 MAINTENANCE**

A Provide a separate maintenance contract for specified maintenance service.

B Perform maintenance using competent personnel in the direct employ of the system installer.

C Provide service and maintenance of equipment installed under this section for one year from the Date of Substantial Completion.

**END OF SECTION 21 30 00**

**SECTION 22 05 13**

**COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A General construction and requirements.

B Applications.

### 1.02 REFERENCE STANDARDS

A NEMA MG 1 - Motors and Generators; 2021.

B NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

## PART 2 PRODUCTS

### 2.01 GENERAL CONSTRUCTION AND REQUIREMENTS

A Construction:

1. Open drip-proof type except where specifically noted otherwise.
2. Design for continuous operation in 104 degrees F environment.
3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

B Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

C Wiring Terminations:

1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

### 2.02 APPLICATIONS

**END OF SECTION 22 05 13**

# SECTION 22 05 16
# EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Flexible pipe connectors.
B Expansion joints and compensators.
C Pipe loops, offsets, and swing joints.

### 1.02 REFERENCE STANDARDS

A ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.
B ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.
C ASME B16.11 - Forged Fittings, Socket-Welding and Threaded; 2021.
D ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2022.
E EJMA (STDS) - EJMA Standards; Tenth Edition.
F FM (AG) - FM Approval Guide; Current Edition.
G ITS (DIR) - Directory of Listed Products; Current Edition.
H UL (DIR) - Online Certifications Directory; Current Edition.

### 1.03 SUBMITTALS

A Product Data:
1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

B Manufacturer's Instructions: Indicate manufacturer's installation instructions, special procedures, and external controls.
C Maintenance Data: Include adjustment instructions.
D Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.

## PART 2 PRODUCTS

### 2.01 REGULATORY REQUIREMENTS

A Comply with UL (DIR) requirements.

## PART 3 EXECUTION

### 3.01 INSTALLATION

A Install in accordance with manufacturer's instructions.
B Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.
C Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.
D Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.
E Anchor pipe to building structure where indicated. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.
F Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

**END OF SECTION 22 05 16**

# SECTION 22 05 17
# SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Pipe sleeves.

B Pipe sleeve-seals.

### 1.02 REFERENCE STANDARDS

A ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2022a.

B ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).

### 1.03 SUBMITTALS

A Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

B Product data: Pipe Sleeve-Seals

### 1.04 QUALITY ASSURANCE

A Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum seven years documented experience.

B Installer Qualifications: Company specializing in performing work of the type specified this section.

1. Minimum three years experience.
2. Approved by manufacturer.

C Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

### 1.05 DELIVERY, STORAGE, AND HANDLING

A Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

### 1.06 WARRANTY

A Correct defective Work within a five year period after Date of Substantial Completion.

## PART 2 PRODUCTS

### 2.01 PIPE SLEEVES

A Manufacturers:

1. Flexicraft Industries
2. GPT Industries - LinkSeal
3. Metraflex
4. EJ Prescott

B Vertical Piping:

1. Schedule 40 steel sleeve
2. Sleeve Length: 2 inches above finished floor.
3. Provide silicone sealant for watertight joint when not a rated penetration.
4. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
5. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

C Pipe passing through interior walls and/or non-rated partitions

1. Schedule 40 steel sleeve. Pack opening with mineral wool.

D Pipe Passing Through Below Grade Exterior Walls:

1. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

E Pipe Passing Through Mechanical, Laundry, and Animal Room Floors above Basement:

1. Galvanized steel pipe or black iron pipe with asphalt coating.
2. Connect sleeve with floor plate except in mechanical rooms.

F Clearances:

1. Provide allowance for insulated piping.

2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external pipe diameter, including insulation.
3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.

**2.02 PIPE-SLEEVE SEALS**

A Manufacturers:
1. Flexicraft Industries; PipeSeal: www.flexicraft.com/#sle.
2. GPT Industries - LinkSeal.
3. Metraflex.

B Modular Mechanical Seal:
1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
2. Provide watertight seal between pipe and wall/casing opening.
3. Elastomer element size and material in accordance with manufacturer's recommendations.
4. Glass reinforced plastic pressure end plates.

C Sealing Compounds:
1. Provide packing and sealing compound to fill pipe to sleeve thickness.
2. Combined packing and sealing compounding to match partition fire-resistance hourly rating.

**PART 3 EXECUTION**

**3.01 PREPARATION**

A Ream pipe and tube ends. Remove burrs.

B Remove scale and foreign material, from inside and outside, before assembly.

**3.02 INSTALLATION**

A Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B Install piping to conserve building space, to not interfere with use of space and other work.

C Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Pipe Sleeves shall be sized with clearances around pipe based on Code Required Dimensions.

D Structural Considerations: Do not penetrate building structural members unless indicated.

E Provide sleeves when penetrating all footings, floors, and walls. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

F Manufactured Sleeve-Seal Systems:
1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a water-tight seal.
6. Install in accordance with manufacturer's recommendations.

G When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

**3.03 CLEANING**

A Upon completion of work, clean all parts of the installation.

B Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

**END OF SECTION 22 05 17**

# SECTION 22 05 19
# METERS AND GAUGES FOR PLUMBING PIPING

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Positive displacement meters.
B Flow meters.
C Pressure gauges and pressure gauge taps.
D Thermometers and thermometer wells.
E Static pressure gauges.
F Filter gauges.

### 1.02 REFERENCE STANDARDS

A ASME B40.100 - Pressure Gauges and Gauge Attachments; 2022.
B ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014 (Reapproved 2020).
C ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014 (Reapproved 2021).
D AWWA C700 - Cold-Water Meters -- Displacement Type, Metal Alloy Main Case; 2020.
E AWWA C701 - Cold-Water Meters -- Turbine Type, for Customer Service; 2019.
F AWWA C702 - Cold-Water Meters -- Compound Type; 2019.
G AWWA M6 - Water Meters -- Selection, Installation, Testing, and Maintenance; 2012, with Addendum (2018).
H UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service; Current Edition, Including All Revisions.

### 1.03 SUBMITTALS

A Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.
B Project Record Documents: Record actual locations of components and instrumentation.
C Operation and Maintenance Data: For Closeout.
D Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Extra Pressure Gauges: One of each type and size.

### 1.04 FIELD CONDITIONS

A Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

## PART 2 PRODUCTS

### 2.01 POSITIVE DISPLACEMENT METERS (LIQUID)

### 2.02 LIQUID FLOW METERS

A Manufacturers:
1. E-Mon
2. Onicon Model F-1230
3. SeaMetrics

B Water Flow Meter shall be Dual Turbine Flow Meter with local mounted display module with digital display, complete with installation of all hardware necessary to enable insertion and removal of the meter without system shutdown.
1. The flow meter shall be hand-insertable without system shutdown.
2. The flow meter shall have dual turbines with jewel bearing systems, electronic impedance-based sensing and an averaging circuit to reduce measurement errors due to swirl and flow profile distortion.
3. Wetted metal components shall be nickel-plated brass.
4. The standard model maximum operating temperature shall be 180°F, 200°F peak, with ambient temperature range of -5°F to 160°F.
5. Maximum operating pressure shall be 400 psi.
6. Pressure drop shall be less than 1 psi at 20 ft/s in 2-1/2” pipe, decreasing in larger pipes and lower velocities.

7. Each flow meter shall be individually wet-calibrated against a primary volumetric standard traceable to NIST. The manufacturer's certificate of calibration shall be provided with each flow meter.
8. Accuracy shall be within ± 0.5% of rate at the calibrated velocity, within ± 1% of rate over a 10:1 turndown (3.0 to 30 ft/s) and within ± 2% of rate over a 50:1 turndown (from 0.4 to 20ft/s).
9. Electrical requirement 120/24, provide with control transformer.
10. The flow meter shall include integral digital output, isolated solid state dry contact, 100mA, 50V divided output.
11. The flow meter shall be covered by the manufacturer's two year warranty.
12. Provide standard electrical connection, 10' of 5-wire cable with 3/4-in. NPT conduit connection.

C Display Module shall be digital, converting the results of the insertion flow meter to display flow rate and total volume.

1. Housing shall be 6" x 6" x 4" NEMA 4 steel enclosure, wall mount.
2. Electrical requirement shall be 120/1/60.
   a. Output voltage (nominal): +24 VDC at 200mA.
3. Indicators include multi-functioning LCD(s) with two buttons for mode selection, total reset, and programming, providing 6-digit rate and 8-digit totalization. (Total reset switch can be disabled via programming.)
4. Programming is set at factory for particular flow meter and pipe size. Field programming is possible.
5. Non volatile EEPROM memory retains all programming parameters in the event of power loss.
6. Input is 0-15V pulse output from insertion flow meter.

**2.03 PRESSURE GAUGES**

A Manufacturers:

1. Dwyer Instruments, Inc: www.dwyer-inst.com.
2. Moeller Instrument Co., Inc: www.moellerinstrument.com.
3. Omega Engineering, Inc: www.omega.com.

B Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.

1. Case: Steel with brass bourdon tube.
2. Size: 4-1/2 inch diameter.
3. Mid-Scale Accuracy: One percent.
4. Scale: Psi.

**2.04 PRESSURE GAUGE TAPPINGS**

A Gauge Cock: Tee or lever handle, brass for maximum 150 psi.

**2.05 STEM TYPE THERMOMETERS**

A Manufacturers:

1. Dwyer Instruments, Inc: www.dwyer-inst.com.
2. Omega Engineering, Inc: www.omega.com.
3. Weksler Glass Thermometer Corp: www.wekslerglass.com.

B Thermometers - Fixed Mounting: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish.

1. Size: 9 inch scale.
2. Window: Clear Lexan.
3. Accuracy: 2 percentper ASTM E77.
4. Calibration: Degrees F.

C Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.

1. Size: 9 inch scale.
2. Window: Clear Lexan.
3. Accuracy: 2 percentper ASTM E77.
4. Calibration: Degrees F.

**2.06 THERMOMETER SUPPORTS**

A Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

**2.07 TEST PLUGS**

A Test Plug: 1/4 inch or 1/2 inch stainless steel fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with Nordel core for temperatures up to 350 degrees F.

B Test Kit: Carrying case, internally padded and fitted containing one 2-1/2 inch diameter pressure gauges, one gauge adapters with 1/8 inch probes, two 1 inch dial thermometers.

**2.08 STATIC PRESSURE GAUGES**

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A Install in accordance with manufacturer's instructions.

B The Contractor shall set the flow metering system in service to operating conditions as a part of this contract.

C Store all components prior to installation in clean, dry place to protect them from construction dirt, water etc. Handle with care to avoid damaging finish or internal components.

D Provide one pressure gauge per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gauge.

E Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

F Coil and conceal excess capillary on remote element instruments.

G Provide instruments with scale ranges selected according to service with largest appropriate scale.

H Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

I Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

J Locate test plugs adjacent thermometers and thermometer sockets.

**END OF SECTION 22 05 19**

# SECTION 22 05 23
# GENERAL-DUTY VALVES FOR PLUMBING PIPING

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Applications
B General requirements
C Angle valves
D Ball valves
E Butterfly valves
F Check valves
G Globe valves
H Plug valves

### 1.02 ABBREVIATIONS AND ACRONYMS

A CWP: Cold working pressure.
B EPDM: Ethylene propylene copolymer rubber.
C NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
D NRS: Non-rising stem.
E OS&Y: Outside screw and yoke.
F PTFE: Polytetrafluoroethylene.
G RS: Rising stem.
H SWP: Steam working pressure.
I TFE: Tetrafluoroethylene.
J WOG: Water, oil, and gas.

### 1.03 REFERENCE STANDARDS

A ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).
B ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.
C ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.
D ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2022.
E ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
F ASME B16.34 - Valves — Flanged, Threaded, and Welding End; 2020.
G ASME B31.9 - Building Services Piping; 2020.
H ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.
I ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.
J ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).
K ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).
L ASTM B61 - Standard Specification for Steam or Valve Bronze Castings; 2015 (Reapproved 2021).
M ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.
N AWWA C606 - Grooved and Shouldered Joints; 2022.
O MSS SP-45 - Drain and Bypass Connections; 2020.
P MSS SP-67 - Butterfly Valves; 2022.
Q MSS SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends; 2011.
R MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends; 2018.
S MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service; 2010a.
T MSS SP-78 - Gray Iron Plug Valves, Flanged and Threaded Ends; 2011.
U MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.
V MSS SP-85 - Gray Iron Globe and Angle Valves, Flanged and Threaded Ends; 2011.
W MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .
X NSF 61 - Drinking Water System Components - Health Effects; 2022, with Errata.
Y NSF 372 - Drinking Water System Components - Lead Content; 2022.

**1.04 SUBMITTALS**

A Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

B Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

C Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

D Maintenance Materials: Furnish Owner with one wrench for every five plug valves, in each size of square plug valve head.

**1.05 QUALITY ASSURANCE**

A Manufacturer:

1. Obtain valves for each valve type from single manufacturer.
2. Company must specialize in manufacturing products specified in this section, with not less than 10 years of documented experience.

B Welding Materials and Procedures: Comply with ASME BPVC-IX.

**1.06 DELIVERY, STORAGE, AND HANDLING**

A Prepare valves for shipping as follows:

1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
2. Protect valve parts exposed to piped medium against rust and corrosion.
3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
5. Secure check valves in either the closed position or open position.
6. Adjust butterfly valves to closed or partially closed position.

B Use the following precautions during storage:

1. Maintain valve end protection and protect flanges and specialties from dirt.
   a. Provide temporary inlet and outlet caps.
   b. Maintain caps in place until installation.
2. Store valves in shipping containers and maintain in place until installation.
   a. Store valves indoors in dry environment.
   b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

**1.07 EXERCISE THE FOLLOWING PRECAUTIONS FOR HANDLING:**

A Handle large valves with sling, modified to avoid damage to exposed parts.

B Avoid the use of operating handles or stems as rigging or lifting points.

**PART 2 PRODUCTS**

**2.01 APPLICATIONS**

A See drawings for specific valve locations.

B NOTE - Gate Valves are not approved for use without specific prior approval from the engineer.

C Balancing Valves (cicuit setters) shall be Thermostatic Balancing Valves with Service/Shutoff Ball Valves at either end, inline strainer, and T&P Ports on either side of valve such as Cicuit Solver by ThermOmegaTech Model CSUAS or approved equal.

D Provide the following valves for the applications if not indicated on drawings:

1. Shutoff: Ball valve required except may be Butterfly on 2-1/2" piping and larger
2. Dead-End: Single-flange butterfly (lug) type.
3. Throttling: Provide ball.
4. Swing Check (Pump Outlet):
   a. 2 NPS and Smaller: Bronze swing check valves with bronze disc.
   b. 2-1/2 NPS and Larger for Domestic Water: Iron swing check valves with closure control or center-guided, metal or resilient seat check valves.
   c. 2-1/2 NPS and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

E Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.

F Required Valve End Connections for Non-Wafer Types:
1. Steel Pipe:
   a. 2 NPS and Smaller: Threaded ends.
   b. 2-1/2 NPS to 4 NPS: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.
   c. 5 NPS and Larger: Grooved or flanged ends.
   d. Grooved-End Copper Tubing and Steel Piping: Grooved.
2. Copper Tube:
   a. 2 NPS and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
   b. 2-1/2 NPS to 4 NPS: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.
   c. 5 NPS and Larger: Grooved or flanged ends.

G Low Pressure, Compressed Air Valves 150 psig or Less:
1. 2 NPS and Smaller:
   a. Bronze and Brass: Provide with solder-joint, threaded, or press-fitting ends.
   b. Ball: Two piece, full port, brass or bronze with stainless-steel trim.
   c. Bronze Lift Check: Class 125, bronze disc.
   d. Bronze Swing Check: Class 125, bronze disc.

H High Pressure, Compressed Air Valves 150 psig to 200 psig:
1. 2 NPS and Smaller:
   a. Bronze and Brass: Provide with solder-joint or threaded ends.
   b. Ball: Two piece, full port, brass or bronze with stainless-steel trim.
   c. Bronze Lift Check: Class 125, bronze disc.
   d. Bronze Swing Check: Class 125, bronze disc.

I Domestic, Hot and Cold Water Valves:
1. 2 NPS and Smaller:
   a. Bronze and Brass: Provide with solder-joint, threaded, or press-fitting ends.
   b. Bronze Angle: Class 125, bronze disc.
   c. Ball: Two piece, full port, brass or bronze with stainless-steel trim.
   d. Bronze Swing Check: Class 125, bronze disc.
   e. Bronze Gate: Class 125, NRS.
   f. Bronze Globe: Class 125, bronze disc.
2. 2-1/2 NPS and Larger:
   a. Iron, 2-1/2 NPS to 4 NPS: Provide with threaded or flanged ends.
   b. Iron Ball: Class 150.
   c. Iron Single-Flange Butterfly: 200 CWP, EPDM seat, aluminum-bronze disc.
   d. Iron Grooved-End Butterfly: 175 CWP.
   e. Iron Swing Check: Class 125, metal seats.
   f. Iron Swing Check with Closure Control: Class 125, lever and spring.
   g. Iron Grooved-End Swing Check: 300 CWP.
   h. Iron Center-Guided Check: Class 125, compact-wafer, metal seat.
   i. Iron Plate-Type Check: Class 125; single plate; metal seat.
   j. Iron Globe: Class 125.

J Sanitary Waste, Storm Drainage, and Force-Main Piping Water Valves:
1. 2 NPS and Smaller:
   a. Bronze and Brass: Provide with solder-joint or threaded.
   b. Bronze Angle: Class 125, bronze disc.
   c. Ball: One piece, full port, brass or bronze with stainless-steel trim.
   d. Bronze Swing Check: Class 125, bronze disc.
   e. Bronze Gate: Class 125, NRS.
   f. Bronze Globe: Class 125, bronze disc.

2. 2-1/2 NPS and Larger:
    a. Iron, 2-1/2 NPS to 4 NPS: Provide with threaded or flanged ends.
    b. Iron Ball: Class 150.
    c. Iron Swing Check: Class 125, metal seats.
    d. Iron Swing Check with Closure Control: Class 125, lever and spring.
    e. Iron Grooved-End Swing Check: 300 CWP.
    f. Iron Gate: Class 125, NRS.
    g. Iron Globe: Class 125.
    h. Lubricated Plug: Class 125, regular gland.

**2.02 GENERAL REQUIREMENTS**

A Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B Valve Sizes: Match upstream piping unless otherwise indicated.

C Valve Actuator Types:
1. Gear Actuator: Quarter-turn valves 8 NPS and larger.
2. Handwheel: Valves other than quarter-turn types.
3. Hand Lever: Quarter-turn valves 6 NPS and smaller except plug valves.
4. Wrench: Plug valves with square heads.

D Valves in Insulated Piping: With 2 NPS stem extensions and the following features:
1. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
2. Butterfly Valves: Extended neck.
3. Memory Stops: Fully adjustable after insulation is installed.

E Valve-End Connections:
1. Threaded End Valves: ASME B1.20.1.
2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
3. Pipe Flanges and Flanged Fittings 1/2 NPS through 24 NPS: ASME B16.5.
4. Solder Joint Connections: ASME B16.18.
5. Grooved End Connections: AWWA C606.

F General ASME Compliance:
1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
2. Solder-joint Connections: ASME B16.18.
3. Building Services Piping Valves: ASME B31.9.

G Valve Materials for Potable Water: NSF 61 and NSF 372.

H Bronze Valves:
1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

I Valve Bypass and Drain Connections: MSS SP-45.

J Source Limitations: Obtain each valve type from a single manufacturer.

**2.03 BRONZE ANGLE VALVES**

A Class 125: CWP Rating: 200 psig:.
1. Comply with MSS SP-80, Type 1.
2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
3. Ends: Threaded
4. Stem: Bronze
5. Disc: Bronze
6. Packing: Asbestos free
7. Handwheel: Bronze or aluminum

**2.04 BRASS BALL VALVES**

A Two Piece, Full Port with Stainless Steel Trim:
1. Comply with MSS SP-110
2. SWP Rating: 150 psig.

3. CWP Rating: 600 psig.
4. Body: Forged brass.
5. Ends: Threaded or soldered
6. Seats: PTFE or TFE
7. Stem: Stainless Steel
8. Ball: Chrome-plated brass

**2.05 BRONZE BALL VALVES**

A Two Piece, Full Port with Stainless Steel Trim:

1. Comply with MSS SP-110
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
4. Body: Bronze.
5. Ends: Threaded.
6. Seats: PTFE.
7. Stem: Stainless steel
8. Ball: Stainless steel, vented

**2.06 STAINLESS STEEL BALL VALVES**

A Two Piece, Full Port with Stainless Steel Trim:

1. Comply with MSS SP-110
2. SWP Rating: 150 psig.
3. CWP Rating: 1000 psig.
4. Body: Stainless steel
5. Seats: PFTE
6. Stem: Stainless steel
7. Ball: Stainless steel

**2.07 IRON BALL VALVES**

A Class 125, Full Port, Stainless Steel Trim:

1. Comply with MSS SP-72.
2. CWP Rating: 200 psig.
3. Body: ASTM A536 Grade 65-45-12, ductile iron.
4. Ends: Flanged
5. Seats: PTFE
6. Stem: Stainless steel
7. Ball: Stainless steel
8. Operator: Lever, with locking handle.

**2.08 IRON, SINGLE FLANGE BUTTERFLY VALVES**

A Lug type: Bi-directional dead-end service without use of downstream flange.

1. Comply with MSS SP-67, Type I.
2. CWP Rating: 200 psig.
3. Body: ASTM A126, cast iron or ASTM A536, ductile iron.
4. Stem: One or two-piece stainless steel.
5. Seat: EPDM
6. Disc: Stainless steel

**2.09 IRON, GROOVED-END BUTTERFLY VALVES**

A CWP Rating: 175 psig (1200 kPa).

1. Comply with MSS SP-67, Type I.
2. Body: Coated ductile iron
3. Stem: Two-piece stainless steel
4. Disc: Coated ductile iron
5. Disc Seal: EPDM

**2.10 BRONZE LIFT CHECK VALVES**

A Class 125:

1. Comply with MSS SP-80, Type 1, Metal Disc to Metal Seat and Type 2, Nonmetallic Disc to Metal Seat.
2. CWP Rating: 200 psig.
3. Design: Vertical flow
4. Body: Comply with ASTM B61 or ASTM B62, bronze
5. Ends: Threaded as indicated
6. Disc (Type 1): Bronze.

**2.11 BRONZE SWING CHECK VALVES**

A Class 125: CWP Rating: 200 psig (1380 kPa).
1. Comply with MSS SP-80, Type 3
2. Design: Horizontal flow
3. Body: Bronze, ASTM B62
4. Ends: Threaded as indicated
5. Disc: Bronze

**2.12 IRON SWING CHECK VALVES**

A Class 125:
1. Comply with MSS SP-71, Type I.
2. CWP Rating: 200 psig.
3. Design: Clear or full waterway.
4. Body: ASTM A126, gray iron with bolted bonnet.
5. Ends: Flanged as indicated.
6. Trim: Composition.
7. Seat Ring and Disc Holder: Bronze.
8. Disc: PTFE or ____.
9. Gasket: Asbestos free.

B Class 250:
1. Comply with MSS SP-71, Type I.
2. CWP Rating: 500 psig.
3. Design: Clear or full waterway.
4. Body: ASTM A126, gray iron with bolted bonnet.
5. Ends: Flanged as indicated
6. Trim: Bronze
7. Metal Seat
8. Gasket: Asbestos free

**2.13 IRON GROOVED-END SWING CHECK VALVES**

A 300 CWP:
1. CWP Rating: 300 psig.
2. Body: ASTM A536, Grade 65-45-12 ductile iron.
3. Seal: EPDM
4. Disc: Stainless steel
5. Coating: Black, non-lead paint

**2.14 IRON CENTER-GUIDED CHECK VALVES**

A Class 125, Compact-Wafer:
1. Comply with MSS SP-125.
2. CWP Rating: 200 psig.
3. Body: 316 stainless steel.
4. Metal Seat: Stainless steel.

B Class 125, Globe:
1. Comply with MSS SP-125.
2. CWP Rating: 200 psig.
3. Body: Stainless steel.
4. Style: Spring loaded.

5. Ends: Flanged.
6. Metal Seat: Stainless steel.

C Class 150, Compact-Wafer:
1. Comply with MSS SP-125.
2. CW P Rating: 300 psig.
3. Body: 316 Stainless steel.
4. Metal Seat: Stainless steel.

D Class 150, Globe:
1. Comply with MSS SP-125.
2. CWP Rating: 300 psig.
3. Body: Stainless steel.
4. Style: Spring loaded.
5. Ends: Flanged.
6. Metal Seat: Stainless steel.

**2.15 IRON PLATE TYPE CHECK VALVES**

A Class 125 Single-Plate:
1. Comply with API STD 594.
2. CWP Rating: 200 psig.
3. Design: Wafer, spring-loaded plate.
4. Body: ASTM A126, gray iron.
5. Resilient Seat: EPDM.

B Class 125, Dual-Plate:
1. Comply with API STD 594.
2. CWP Rating: 200 psig.
3. Design: Wafer, spring-loaded plates.
4. Body: ASTM A126, gray iron.
5. Resilient Seat: EPDM.

C Class 150, Dual-Plate:
1. Comply with API STD 594.
2. CWP Rating: 300 psig.
3. Design: Wafer, spring-loaded plates.
4. Body: ASTM A395/A395M or ASTM A536, ductile iron.
5. Resilient Seat: EPDM.

D Class 250, Single-Plate:
1. Comply with API STD 594.
2. CWP Rating: 400 psig.
3. Design: Wafer, spring-loaded plate.
4. Body: ASTM A126, gray iron.
5. Resilient Seat: EPDM.

**2.16 BRONZE GLOBE VALVES**

A Class 125: CWP Rating: 200 psig: and Class 150: CWP Rating: 300 psig:.
1. Comply with MSS SP-80, Type 1.
2. Body: ASTM B62, bronze with integral seat and screw-in bonnet.
3. Ends: Threaded or solder joint
4. Stem: Bronze
5. Disc: Bronze
6. Packing: Asbestos free
7. Handwheel: Bronze or aluminum

**2.17 IRON GLOBE VALVES**

A Class 125: CWP Rating: 200 psig:.
1. Comply with MSS SP-85, Type I.
2. Body: Gray iron; ASTM A126, with bolted bonnet

3. Ends: Flanged
4. Trim: Bronze
5. Packing and Gasket: Asbestos free
6. Operator: Handwheel or chainwheel

**2.18 STAINLESS STEEL GLOBE VALVES**

A Class 150: CWP Rating: 300 psig:.
1. Comply with ASME B16.34 for pressure-temperature range.
2. Body: 316L stainless steel, with bolted bonnet.
3. Ends: Flanged.
4. Trim: Stainless steel.
5. Packing and Gasket: Asbestos free.
6. Operator: Handwheel.

**2.19 LUBRICATED PLUG VALVES**

A Regular Gland and Cylindrical with Threaded Ends:
1. Comply with MSS SP-78, Type II.
2. Class 125: CWP Rating: 200 psig.
3. Class 250: CWP Rating: 400 psig.
4. Body: ASTM A48/A48M or ASTM A126, cast iron with lubrication sealing system.
5. Pattern: Regular or short.
6. Plug: Cast iron or bronze with sealant groove.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.

B Verify valve parts to be fully operational in all positions from closed to fully open.

C Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.

D Should valve is determined to be defective, replace with new valve.

**3.02 INSTALLATION**

A Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

B Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

C Where valve support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

D Provide the Owner with a valve chart indicating location, valve number, size, manufacturer, purpose, etc. Frame valve chart under glass.

E Provide brass or stainless steel valve tags on all valves. Refer to Identification for Plumbing Piping and Equipment Specification for further information.

F Provide access panel, minimum 18” square, where valves are located above gypsum board ceiling. Access panel shall have fire rating to match ceiling rating, if ceiling is rated. Access panel shall be painted to match ceiling.

G Provide dot on ceiling grid where valves are located above lay-in ceiling. Refer to Identification for Plumbing Piping and Equipment Specification for further information.

H The Contractor shall set in service all valves to operating conditions as part of his Contract. Where valves with manual settings are required, valves shall be calibrated by plumbing contractor for a balanced flow.

I All valve stems shall be accessible and in no case shall valve stems be installed below horizontal.

J All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

K In no case shall raised face flanges be bolted to flat face flanges.

L All flanged connections shall be gasketed.

M All grooved joint 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.

N When soldering valves with TFE or PTFE Seats, contractor shall remove valve body to protect seats.

O All elastomers used for seals and seats shall be UL Classified in accordance with NSF-61/NSF-372 for potable water service

P Install check valves where necessary to maintain direction of flow as follows:

1. Lift Check: Install with stem plumb and vertical.
2. Swing Check: Install horizontal maintaining hinge pin level.
3. Orient plate-type and center-guided into horizontal or vertical position, between flanges.

**END OF SECTION 22 05 23**

# SECTION 22 05 29
# HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Support and attachment components for equipment, piping, and other plumbing work for a completely and properly supported plumbing system.

### 1.02 REFERENCE STANDARDS

A ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2023.

D ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

E ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

F ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

G ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

H ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023c.

I ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).

J MFMA-4 - Metal Framing Standards Publication; 2004.

K MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

L NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A Coordination:

1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Contractor is responsible for reviewing complete construction document package and determining, prior to the start of work, which portions of the above grade structural slabs are hard rock concrete and/or lightwieght insulating concrete and shall review the structural engineer's requirements for attachment to slabs. Unistrut or other forms of support required to span multiple joists or beams shall be part of the contractors bid price. No additional monies will be given for support steel or other members required where piping may not be allowed to be supported by the concrete deck above.

B Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

### 1.04 SUBMITTALS

A Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, post-installed concrete and masonry anchors, thermal insulated pipe supports, and all devices required for a complete hanger and support system.

B Approved Manufacturers: Eaton / Cooper B-Line, Thomas & Betts Corporation, nVent Caddy (Erico), Unistrut, or prior Engineer Approved Equal

C Furnish all support materials, associated fittings, accessories, and hardware produced by a single manufacturer.

**1.05 QUALITY ASSURANCE**

A Comply with applicable building code.

B Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.

D Installer Qualifications for Field-Welding: As specified in Section 05 50 00.

E Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

**1.06 DELIVERY, STORAGE, AND HANDLING**

A Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

**PART 2 PRODUCTS**

**2.01 SUPPORT AND ATTACHMENT COMPONENTS**

A General Requirements:

1. Comply with MSS SP-58.
2. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
3. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
   a. Indoor Dry Locations: Use zinc-plated steel or galvanized steel, or epoxy plated steel unless otherwise indicated.
   b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
   c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
   d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B Metal Channel (Strut) Framing Systems:

1. Provide factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
2. Comply with MFMA-4.
3. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch.
4. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.

C Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

1. Minimum Size, Unless Otherwise Indicated or Required:
   a. Equipment Supports: 1/2 inch diameter.
   b. Piping up to 1 inch (27 mm) nominal: 1/4 inch diameter.
   c. Piping larger than 1 inch (27 mm) nominal: 3/8 inch diameter.
   d. Trapeze Support for Multiple Pipes: 3/8 inch diameter.

D Pipe Supports:

1. Liquid Temperatures Up To 122 degrees F:
   a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
   b. Support From Below: MSS SP-58 Types 35 through 38.

E Beam Clamps: MSS SP-58 Types 19 through 23, 25 or 27 through 30 based on required load.

1. Material: ASTM A36/A36M carbon steel or ASTM A181/A181M forged steel.

2. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.

F Riser Clamps:
1. Provide copper plated clamps for copper tubing support.
2. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.

G Offset Pipe Clamps: Double-leg design two-piece pipe clamp.

H Strut Clamps: Two-piece pipe clamp.

I Insulation Clamps: Two bolt-type clamps designed for installation under insulation.

J Pipe Hangers: For a given pipe run, use hangers of the same type and material.
1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
2. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

K Intermediate Pipe Guides: Use pipe clamps with oversize pipe sleeve that provides clearance around pipe.
1. Pipe Diameter 6 inches and Smaller: Provide minimum clearance of 0.16 inch.
2. Pipe Diameter 8 inches: Provide U-bolts with double nuts providing minimum clearance of 0.28 inch.
3. Pipe Diameter 8 inches: 0.625 inch U-bolt.
4. Pipe Diameter 10 inches: 0.75 inch U-bolt.
5. Pipe Diameter 12 to 16 inches: 0.875 inch U-bolt.
6. Pipe Diameter 18 to 30 inches: 1 inch U-bolt.

L Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.

M Nonpenetrating Rooftop Supports for Low-Slope Roofs:
1. Provide steel pedestals with thermoplastic or rubber base that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
3. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
4. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

N Anchors and Fasteners:
1. Manufacturers - Mechanical Anchors:
   a. Hilti, Inc
   b. ITW Red Head, a division of Illinois Tool Works, Inc
   c. Powers Fasteners, Inc
   d. Simpson Strong-Tie Company Inc
   e. nVent CADDY (Erico).
2. Manufacturers - Powder-Actuated Fastening Systems:
   a. Hilti, Inc
   b. ITW Ramset, a division of Illinois Tool Works, Inc
   c. Powers Fasteners, Inc
   d. Simpson Strong-Tie Company Inc
3. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
4. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
5. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
6. Hollow Masonry: Use toggle bolts.
7. Hollow Stud Walls: Use toggle bolts.
8. Steel: Use beam clamps, machine bolts, or welded threaded studs.
9. Sheet Metal: Use sheet metal screws.
10. Wood: Use wood screws.
11. Plastic and lead anchors are not permitted.
12. Powder-actuated fasteners are permitted only as follows:

a. Where approved by Architect.
b. Use only threaded studs; do not use pins.

13. Hammer-driven anchors and fasteners are permitted only as follows: Wood Frame Construction
14. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Comply with MFMA-4.
    b. Channel Material: Use galvanized steel.
    c. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch minimum base metal thickness.
    d. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
15. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A Verify that field measurements are as indicated.
B Verify that mounting surfaces are ready to receive support and attachment components.
C Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 INSTALLATION

A Install products in accordance with manufacturer's instructions.
B Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
C Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
D Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
E Unless specifically indicated or approved by Architect, do not provide support from roof deck.
F Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
G Equipment Support and Attachment:
    1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
    2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
    3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
    4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 4 inch high concrete pad constructed in accordance with Section 03 30 00.
    5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
H Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.
I Secure fasteners according to manufacturer's recommended torque settings.
J Remove temporary supports.
K The actual arrangement of the piping shall follow the general locations shown on the Drawings, such that clearances, line drainage, etc. shall be maintained.
L In no case shall this Contractor be allowed to cut or reduce the specified covering to allow the application of a smaller hanger than required.
M Hangers supporting vertical and horizontal copper piping, sized 1 ½” in diameter and larger, shall be spaced on not more than 10-foot centers and 30” of each change or direction.
N Hangers supporting vertical and horizontal copper piping, sized 1 ¼” in diameter and smaller, shall be spaced on not more than 6-foot centers and 30” of each change of direc-tion.
O Hangers supporting vertical and horizontal PVC piping of any size shall be spaced on not more than 4-foot centers and 30” of each change of direction.

P Hangers supporting vertical and horizontal CPVC piping 1 ¼" in diameter and larger shall be spaced on not more than 4-foot centers and 30" of each change of direction.

Q Hangers supporting vertical and horizontal CPVC piping 1" in diameter and smaller shall be spaced on not more than 3-foot centers and 30" of each direction.

R Hangers supporting horizontal cast iron piping of any size shall be spaced not more than 5-foot centers and 30" of each change of direction, with a minimum of two hangers per sec-tion.

S Hangers supporting vertical cast iron piping of any size shall be spaced on not more than 10-foot centers and 30" of each change of direction, with a minimum of two hangers per section.

T Rigid support sway bracing shall be provided at changes in direction greater than 45 de-grees for all pipe sizes 4" and larger.

U Vertical risers shall be supported at each floor, 5-feet on center, and/or at changes in direc-tion of pipe.

V Sleeves shall be provided wherever pipes pass through walls, floors and ceilings. Sleeves shall be Schedule 40, black steel, ½" in diameter larger than the pipe or insulation on the pipe. Sleeves through walls and ceilings shall be flush. Sleeves through floors shall extend one inch above finished floor. Sleeves in exterior walls shall be caulked and made water-tight.

**3.03 FIELD QUALITY CONTROL**

A Inspect support and attachment components for damage and defects.

B Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C Correct deficiencies and replace damaged or defective support and attachment components.

**END OF SECTION 22 05 29**

# SECTION 22 05 53
# IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Nameplates.
B Tags.
C Pipe markers.
D Ceiling tacks.
E Valve Tags

### 1.02 REFERENCE STANDARDS

A ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.
B ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

### 1.03 SUBMITTALS

A List: Submit list of wording, symbols, letter size, and color coding for plumbing identification.
B Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
C Product Data: Provide manufacturers catalog literature for each product required.
D Manufacturer's Installation Instructions: Indicate special procedures, and installation.
E Project Record Documents: Record actual locations of tagged valves.

## PART 2 PRODUCTS

### 2.01 IDENTIFICATION APPLICATIONS

A Control Panels: Nameplates.
B Heat Transfer Equipment: Nameplates.
C Major Control Components: Nameplates.
D Piping: Tags.
E Pumps: Nameplates.
F Small-sized Equipment: Tags.
G Tanks: Nameplates.
H Valves: Tags and ceiling tacks where located above lay-in ceiling.
I Water Treatment Devices: Nameplates.

### 2.02 NAMEPLATES

A Manufacturers:
1. Brimar Industries, Inc.: www.pipemarker.com.
2. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
3. Preferred Utilities Mfg. Corp.
4. Seton Identification Products: www.seton.com.
5. Brady Corporation.

B Description: Laminated three-layer plastic with black engraved letters on light contrasting background.
1. Letter Color: Black.
2. Letter Height: 1/4 inch.
3. Background Color: light, contrasting background.
4. Plastic: Comply with ASTM D709.

### 2.03 TAGS

A Manufacturers:
1. Brady Corporation: www.bradycorp.com.
2. Brimar Industries, Inc.: www.pipemarker.com.
3. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
4. Seton Identification Products: www.seton.com.

B Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
C Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

### 2.04 PIPE MARKERS

A Manufacturers:

1. Brady Corporation: www.bradycorp.com.
2. Carlton Industries, Inc.
3. Brimar Industries, Inc.: www.pipemarker.com.
4. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.
5. Seton Identification Products: www.seton.com.

B Comply with ASME A13.1.

C Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D Color: Standard colors for selected plumbing piping, attached at end of Section.

E Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

F Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service. Message must repeat within a maximum of 40". Printed legend shall be indicative of type of underground line. Underground gas lines shall have insulated copper tracer wire, minimum 18 AWG with insulation suitable for direct burial and ends shall terminate above grade.

**2.05 CEILING TACKS**

A Manufacturers:

1. Craftmark Pipe Markers; _____: www.craftmarkid.com/#sle.
2. MSI.
3. Seton.

B Description: Steel with 3/4 inch diameter color coded head.

C Install label on ceiling grid in proximity to device above ceiling. Indicate type of device and associated service on label. (e.g. "CW-21"). Next to label, on ceiling grid, provide round dot.

D Provide custom printed labels, either of vinyl suitable for indoor/outdoor applications or of polypropylene for each device. Utilize portable printer equal to Brady HandiMark Portable Industrial Labeling System.

E Maximum height of label is one inch. Black lettering on white tape. Font size 18.

F Color code as follows unless Owner has their own standard - Contractor to verify prior to start of work:

1. Cold Water: Blue dot
2. Hot Water: Green dot
3. Hot Water Return: Green dot
4. All other valves: Black Dot

**PART 3 EXECUTION**

**3.01 PREPARATION**

A Degrease and clean surfaces to receive adhesive for identification materials.

**3.02 INSTALLATION**

A Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B Install tags with corrosion resistant chain.

C All exposed piping in mechanical rooms, boiler rooms, on and above mezzanine levels, both insulated and uninsulated, shall be either painted or color coded using 0.030" PVC jacketing by the Plumbing Contractor and labeled by the Contractor as per the following schedule:

1. Domestic Cold Water: Blue
2. Domestic Hot Water: Red
3. Makeup Water: Green
4. Fuel Gas: Yellow
5. Non-Potable Water: Purple

D All non-potable water outlets shall include a phenolic sign with yellow background and black letters 1/2" high stating: "NON-POTABLE WATER – NOT SAFE FOR DRINKING"

E Install plastic pipe markers in accordance with manufacturer's instructions.

F Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

G Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

H Use tags on piping 3/4 inch diameter and smaller.
1. Identify service, flow direction, and pressure.
2. Install in clear view and align with axis of piping.
3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

I Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

J Identify water heaters, with plastic nameplates. Small devices may be identified with tags.

K Identify control panels, manual motor starters, combination motor starters, disconnects, emergency shutoff switches, water heater override switches, water heater emergency switches and major control components outside panels with plastic nameplates.

L Identify aquastats or temperature sensors relating to water heaters or valves with nameplates.

M Identify valves in main and branch piping with valve tags.

N Tag automatic controls, instruments, and relays. Key to control schematic.

O Identify water heaters with plastic nameplates indicating unit number and area served.

P Identify pumps with plastic nameplates indicating pump number and system served.

**3.03 SCHEDULES**

A Standard Color Identification for Plumbing Piping unless Owner has their own standard - Contractor to verify prior to start of work (all labels shall be provided with flow arrows):
1. Domestic Cold Water: White Lettering/Green Background
2. Domestic Hot Water: Black Lettering/Yellow Background
3. Domestic Hot Water Return: Black Lettering/Yellow Background
4. Fuel Gas Piping: Black Lettering/Yellow Background
5. Fuel Oil Piping: Black Lettering/Yellow Background
6. Compressed Air: White Lettering/Blue Background
7. Roof Drain: Black Lettering/White Background
8. Overflow Roof Drain: Black Lettering/White Background
9. Condensate Drain: Black Lettering/White Background
10. Non-Potable Water: Black Lettering/Yellow Background

B All medical gas piping shall conform to NFPA 99 marking standards.

**END OF SECTION 22 05 53**

# SECTION 22 05 70
# PLUMBING COORDINATION DRAWINGS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A The Plumbing Contractor shall be responsible for providing ¼ scale coordination drawings for the entire project, format shall be as stated below.

B The drawings shall cover above ceiling space, mechanical rooms, electrical rooms and service yards.

## PART 2 EXECUTION

### 2.01 COORDINATION (REVIT)

A The Plumbing Contractor shall obtain the architectural, structural, and MEP REVIT models from the Architect. The models will be in REVIT 2020.

B The Plumbing Contractor shall produce drawings that indicate all piping, including underground piping, and equipment on ¼ scale drawings. All items shall be drawn to scale, dimensioned and be easily identified. The drawings shall indicate a bottom of pipe.

C The Plumbing Contractor shall provide the Mechanical Contractor a file compatible with Navisworks that indicates all piping and plumbing equipment.

D The overall coordination drawings shall be completed prior to any plumbing, mechanical and electrical work beginning. Start of work, including underground work, without completed Coordination Drawings is at the Contractor's risk.

**END OF SECTION 22 05 70 22 05 70**

# SECTION 22 07 19
# PLUMBING PIPING INSULATION

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Flexible elastomeric cellular insulation.
B Glass fiber insulation.
C Jacketing and accessories.

### 1.02 REFERENCE STANDARDS

A ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2019).
B ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.
C ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.
D ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2022.
E ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).
F ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.
G ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing; 2022.
H ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation; 2022.
I ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).
J ASTM D1056 - Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber; 2020.
K ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023c.
L ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).
M UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

### 1.03 SUBMITTALS

A Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

### 1.04 QUALITY ASSURANCE

A Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.
B Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

### 1.05 DELIVERY, STORAGE, AND HANDLING

A Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

### 1.06 FIELD CONDITIONS

A Maintain ambient conditions required by manufacturers of each product.
B Maintain temperature before, during, and after installation for minimum of 24 hours.

## PART 2 PRODUCTS

### 2.01 REGULATORY REQUIREMENTS

A Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723

### 2.02 GLASS FIBER INSULATION

A Manufacturers:
1. CertainTeed Corporation
2. Johns Manville Corporation
3. Knauf Insulation; Earthwool 1000 Degree Pipe Insulation
4. Owens Corning Corporation

B Insulation: ASTM C547and ASTM C795; rigid molded, noncombustible.
1. K Value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum Service Temperature: 850 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.

C Insulation: ASTM C547and ASTM C795; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.
1. K Value: ASTM C177, 0.23 at 75 degrees F.
2. Maximum Service Temperature: 220 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.

D Insulation: ASTM C547and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
1. K Value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum Service Temperature: 650 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.

E Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm inch.

F Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

G Vapor Barrier Lap Adhesive: Compatible with insulation.

H Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

I Indoor Vapor Barrier Finish:
1. Cloth: Untreated; 9 oz/sq yd weight.

J Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

## 2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A Manufacturers:
1. Aeroflex USA, Inc: www.aeroflexusa.com.
2. Armacell LLC: www.armacell.us.
3. K-Flex USA LLC: www.kflexusa.com.

B Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
1. Minimum Service Temperature: Minus 40 degrees F.
2. Maximum Service Temperature: 220 degrees F.
3. Connection: Waterproof vapor barrier adhesive.

C Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

## 2.04 JACKETING AND ACCESSORIES

A Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive. (INTERIOR)
1. Lagging Adhesive: Compatible with insulation.

B Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet. (EXTERIOR)
1. Thickness: 0.016 inch sheet.
2. Finish: Smooth.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.
5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

# PART 3 EXECUTION

## 3.01 EXAMINATION

A Verify that piping has been tested before applying insulation materials.

B Verify that surfaces are clean and dry, with foreign material removed.

## 3.02 INSTALLATION

A Install in accordance with manufacturer's instructions.

B Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

C All valve handles on insulated piping shall be extended beyond the surface of the insulation using approved listed valve stem handle extensions made by same manufacturer of the valves.

D Exposed Piping in Mechanical Spaces and Exposed to Public View Piping (open ceiling): Shall be covered with eight-ounce canvas jacket, pasted in place and glue sized twice for painting - locate insulation and cover seams in least visible locations. Canvas shall be coated twice with Foster fireproof lagging to assure flame and smoke spread ratings. Coordinate sequencing with painting schedule and finishes - refer to architecture documents for painting requirements at Open-to-View ceilings.

E All waste piping above slab carrying cold condensate, for instance roof drain piping carrying cold condensate from rooftop mechanical units, including traps and floor drain bodies, except in a crawl space, shall be fully insulated as specified herein within the thermal envelope.

F All horizontal storm drain piping above slab on grade and all vertical risers up to, and including, elbows and roof drain bodies, shall be fully insulated as specified herein.

G Closed cell insulation, may be used in lieu of fiberglass on all water pipes - especially in block walls. All Closed cell insulation shall be jacketed with canvas jacketing prior to being painted and shall be jacketed with Prefroemd PVC Covers when exposed to view.

H Insulation shall be finished with a fire retardant coating to attain proper fire rating.

I Glass fiber insulated pipes conveying fluids below ambient temperature:

1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

J Glass fiber insulated pipes conveying fluids above ambient temperature:

1. Provide standard jackets, with vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

K Inserts and Shields:

1. Application: Piping 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert Location: Between support shield and piping and under the finish jacket.
4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

L Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. Refer to referenced Rated Partition and/or Floor Penetration UL Details and Non-Rated Partition and/or Floor Penetration Details in the drawings where applicable.

M All insulation shall be finished with a fire retardant coating to attain proper fire rating.

N Closed cell insulation shall be installed in strict accordance with the manufacturer's installation instructions.

O Insulate fittings with pre-fabricated PVC fitting covers.

P Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

Q Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil, 0.001 inch thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

R Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

**3.03 SCHEDULES**

A Plumbing Systems:

1. Domestic Hot Water Supply:
   a. Glass Fiber Insulation:
      1) Pipe Size Range: 0-6 inch.
      2) Thickness: 1 inch.
   b. Cellular Foam Insulation:
      1) Pipe Size Range: 0-6 inch.
      2) Thickness: 1 inch.
2. Domestic Hot Water Recirculation:
   a. Glass Fiber Insulation:
      1) Pipe Size Range: All sizes.
      2) Thickness: 1 inch.
   b. Polyurethane Foam Insulation:
      1) Pipe Size Range: All sizes.
      2) Thickness: 1/2 inch.
3. Tempered Domestic Water Supply:
   a. Same as Domestic Hot Water Supply
4. Domestic Cold Water:
   a. Glass Fiber Insulation:
      1) Pipe Size Range: All sizes
      2) Thickness: 1/2 inch
      3) Thickness: 1 inch (WCPSS)
   b. Closed Cell Insulation:
      1) Pipe Size Range: All sizes
      2) Thickness: 1/2 inch
      3) Thickness: 1 inch (WCPSS)
5. Roof Drain Bodies:
   a. Glass Fiber Insulation:
      1) Thickness: 1 inch
6. Roof Drainage Above Grade:
   a. Glass Fiber Insulation:
      1) Thickness: 1 inch
7. Mechanical Condensate, including traps and floor drain bodies:
   a. Glass Fiber Insulation:
      1) Pipe Size Range: All sizes.
      2) Thickness: 1 inch.

**END OF SECTION 22 07 19**

**SECTION 22 08 00**
**PLUMBING COMMISSIONING REQUIREMENTS**

## PART 1 - GENERAL

### 1.01 DESCRIPTION

A Commissioning

1. Commissioning is a systematic process of ensuring that all building systems perform interactively according to the owner's project requirements and operational needs. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, performance testing and training. Commissioning during the construction phase is intended to achieve the following specific objectives:
2. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
3. Verify and document proper functional performance of equipment and systems.
4. Verify that O&M documentation is complete.
5. Verify that the Owner's operating personnel are adequately trained.

### 1.02 RELATED WORK

A Section 01 1000 – Summary of Work
B Section 01 3300 – Submittal Procedures
C Section 01 7700 – Closeout Procedures
D Section 01 7823 – Operation and Maintenance Data
E Section 01 7839 – Project Record Document
F Section 01 7900 – Demonstration and Training
G Section 01 9113 – General Commissioning Requirements
H Division 22 - Plumbing

### 1.03 ABBREVIATIONS AND DEFINITIONS

A A/E: Architect, Architect/Engineer, and/or Engineer
B ASI: Architectural Supplemental Instruction
C BAS: Building Automation System
D BoD: Basis of Design. A narrative of how the designer plans to achieve the OPR
E CxA: Commissioning Authority
F Controls Contractor
G CM: Construction Manager
H Cx: Commissioning
I Cx Plan: Commissioning Plan
J Cx RFI: Commissioning Request for Information
K DDC: Direct Digital Control System
L Deficiency: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents and cannot be corrected in five (5) minutes time.
M EC: Electrical Contractor
N FBO: Furnished By Others
O FT: Functional Performance Test
P IAW: In Accordance With
Q MC: Mechanical Contractor
R O&M: Operation and Maintenance
S OPM: Owner Project Manager
T OPR: Owner Project Requirement. A dynamic document expressing how the owner expects the building systems to perform upon project completion.
U PC: Prefunctional Checklist
V RFI: Request for Information
W Sub(s): Subcontractors or Prime Contractor
X TC: Testing Contractor

Y TBD: To Be Determined

**1.04 PLUMBING SYSTEMS TO BE COMMISSIONED**

A Domestic hot water systems
B Natural gas supply equipment
C Sump pumps and sump pump controls

**1.05 SUBMITTALS**

A Refer also to Specification Section 01 9113, Subsection 1.6.
B Provide the CxA a copy of the following items, for the systems to be commissioned:
1. Equipment and System Submittals to include, at minimum, the following:
a. Cut Sheets
b. Performance data
c. Manufacturer's pre-startup checklists
1) Manufacturer's start-up checklists
2) Installation Instructions
d. Shop drawings (including any resubmittals required by the A/E)
e. Test plan
f. Completed field test report, including all completed forms and checklist; and list of all outstanding deficiencies and uncompleted items
g. Operational and maintenance documentation
h. Training plan and training materials
i. As-built documentation

**PART 2 - PRODUCTS**

**2.01 TEST EQUIPMENT**

A Refer to Specification Section 01 9113, Subsection 2.1.
B Instrumentation required to verify readings and test system and equipment performance shall be provided by Contractor and made available to Commissioning Authority. Camera equipment capable of viewing an entire pipe assembly at one time.

**2.02 CX WEB-BASED COMMISSIONING TOOL**

A Refer to Specification Section 01 9113, Subsection 2.1.

**PART 3 - EXECUTION**

**3.01 MEETINGS**

A Refer to Specification Section 01 9113, Subsection 3.3.

**3.02 START-UP, PREFUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT**

A The following procedures apply to all equipment to be commissioned, according to Section 1.4 above.
B General
1. Contractor shall complete plumbing testing as required in sections 22 1118, 22 1314, and 22 3314.
2. Testing Plan
a. The subcontractor responsible for providing and installing the equipment completes the testing plan. The test plan will include checklists and procedures with specific boxes or lines for recording and documenting the tests, and a summary statement with a signature block at the end of the plan.
b. The contractor submits the full test plan to the A/E and CxA for review and approval.
3. Execution of Testing Plan
a. Two weeks prior to testing, the Subs and vendors schedule testing with the OPM, CM and CxA. The performance of the tests are directed and executed by the Sub or vendor.
b. The CxA and possibly the A/E will observe the testing procedures for selected pieces of equipment.
c. The Subs and vendors shall execute testing and provide the CM with a signed and dated copy of the completed testing report. The CM reviews for completion and accuracy, then submits to the CxA and A/E.
d. Only individuals that have direct knowledge and witnessed that a line item task on the testing was actually performed shall initial or check that item off. It is not acceptable for witnessing

supervisors to fill out these forms.

4. Deficiencies, Non-Conformance and Approval in Checklists and Startup
   a. The Sub(s) shall clearly list any outstanding items of the initial testing that were not completed successfully. The testing forms and any outstanding deficiencies shall be provided to the CxA within two days of test completion.
   b. The installing Subs or vendors shall correct all areas that are deficient or incomplete in the tests in a timely manner, and shall notify the CxA as soon as outstanding items have been corrected.
   c. Items left incomplete, which later cause deficiencies or delays during functional performance testing may result in backcharges to the responsible party. Refer to Section 01 9113, 3.7 – Documentation, Non-Conformance and Approval of Tests.

**3.03 FUNCTIONAL PERFORMANCE TESTING, VERIFICATION AND VALIDATION**

A Objectives and Scope

1. The contractor will perform functional performance testing of the water heating equipment and any plumbing automation system integration with the EMS.
2. The objective is to demonstrate that each system is operating according to the owner's project requirements, documented project program, and Contract Documents. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and function of the systems.
3. The CxA develops specific functional test procedures and forms to verify and document proper operation of each piece of equipment and system. The CxA provides a copy of the test procedures to the A/E, OPM and installing Sub who shall review the tests prior to testing. The A/E and Sub(s) shall point out to the CxA any specific problems as related to feasibility, safety, equipment and warranty protection.
4. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.
5. The contractor shall supply all personnel and equipment for the demonstration, including, but not limited to, tools, instruments, ladders, lifts, computers, software, cables, etc. Contractor supplied personnel must be competent with and knowledgeable of all project-specific systems. All training documentation, submittals, installation manuals, and O&Ms, shall be at the job site before demonstration testing commences.
6. Coordination and Scheduling
   a. The CM shall provide sufficient notice to the CxA regarding the Subs completion schedule for the testing of all equipment and systems. The CxA will schedule demonstration and validation after written notification from the CM and affected Subs. The CxA shall direct, witness and document the demonstration retesting of equipment and systems. The Subs shall execute the tests.
   b. In general, functional performance testing shall not be scheduled until all equipment submittals are approved, testing plans are approved, testing has been satisfactorily completed, and testing report has been provided. Scheduling of testing shall be done with a minimum of two weeks notice prior to testing. Testing which occurs outside the presence of the CxA or OPM without written authorization to do so will be required to be re-tested at no expense to the owner.
7. Problem Solving
8. The CxA will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the CM, Subs and A/E.

**3.04 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS**

A Refer to Specification Section 01 9113, Subsection 3.7.

**3.05 OPERATION AND MAINTENANCE MANUALS**

A In addition to installation manuals, the contractor shall provide one copy of the Operation and Maintenance Manuals to the CxA for the systems to be commissioned. The O&M Manuals shall be provided to the CxA at least 8 weeks prior to the start of Functional Testing. O&M Manuals shall be in electronic form, the file format shall be Adobe Acrobat readable document. The document shall be formatted to include level 1 bookmarks that link to each main section of equipment. Refer to specification section 01 9113, subsection

3.8 for further detail.

**3.06 TRAINING OF OWNER PERSONNEL**

A See Specification Section 01 9113, Subsection 3.9.

B Provide designated Owner personnel with comprehensive training in the understanding of the systems and the operation and maintenance of cabling systems.

C Training shall start with classroom sessions, if necessary, followed by hands-on training on each piece of equipment.

**3.07 DEFERRED TESTING**

A See Specification Section 01 9113, Subsection 3.10.

**END OF SECTION 22 08 00**

# SECTION 22 10 05
# PLUMBING PIPING

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Pipe, pipe fittings, specialties, and connections for piping systems.
1. Sanitary Sewer Drain, Waste and Vent Pipe and Fittings
2. Lead-Free Domestic Water Pipe and Fittings
3. Stormwater Drain Pipe and Fittings
4. Condensate Drain Pipe and Fittings
5. Natural or LP Gas Pipe and Fittings
6. Flanges, unions, and couplings
7. Manufactured sleeve-seal systems
8. Water pressure reducing valves
9. Relief valves
10. Strainers

### 1.02 REFERENCE STANDARDS

A ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems; 2015 (Reaffirmed 2020).
B ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.
C ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
D ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
E ASME B31.1 - Power Piping; 2022.
F ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.
G ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
H ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2021.
I ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
J ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.
K ASTM B32 - Standard Specification for Solder Metal; 2020.
L ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
M ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.
N ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.
O ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2016.
P ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2020a.
Q ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2021a.
R ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2020.
S ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2023.
T ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings; 2020.
U ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020.
V ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2020.
W ASTM D2846/D2846M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems; 2019a.

X ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2020.

Y ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2023.

Z ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings; 2022.

AA ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2022).

BB ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing; 2023.

CC ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems; 2023.

DD ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-Linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing; 2023b.

EE AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.

FF AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2017, with Errata (2018).

GG CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2021.

HH NSF 61 - Drinking Water System Components - Health Effects; 2022, with Errata.

II NSF 372 - Drinking Water System Components - Lead Content; 2022.

**1.03 SUBMITTALS**

A Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

B Welder Certificate: Include welders certification of compliance with ASME BPVC-IX.

C Project Record Documents: Record actual locations of valves.

D Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Valve Repacking Kits: One for each type and size of valve.

**1.04 QUALITY ASSURANCE**

A Perform work in accordance with applicable codes.

B Valves: Manufacturer's name and pressure rating marked on valve body.

C Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

D Welder Qualifications: Certified in accordance with ASME BPVC-IX.

E Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

F All wetted components of system shall comply with United States Safe Drinking Water Act (Sec.1417) amended 1-4-2011.

**1.05 DELIVERY, STORAGE, AND HANDLING**

A Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B Provide temporary protective coating on cast iron and steel valves.

C Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

**1.06 FIELD CONDITIONS**

A Do not install underground piping when bedding is wet or frozen.

**PART 2 PRODUCTS**

**2.01 GENERAL REQUIREMENTS**

A Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

B Pipe Bedding - PVC Piping to be bedded in the ground shall be installed according to the requirements and recommendations in ASTM-D2321 and shall be backfilled with Soils meeting the Soils Class III unless otherwise approved by the engineer of record prior to installation. PVC Piping less than 8" in diameter shall be backfilled with material with a maximum aggregate size of 10% of the diameter of the pipe being

covered.

**2.02 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING**

A Cast Iron Pipe: ASTM A74 extra heavy weight.
1. Fittings: Cast iron.
2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.
3. Pipe and Fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and shall be listed with NSF International.

B PVC Pipe: ASTM D2665 or ASTM D3034.
1. Fittings: PVC.
2. Joints: Solvent welded, with ASTM D2564 solvent cement.
3. Foam Core PVC Piping is not allowed.

**2.03 SANITARY SEWER PIPING, ABOVE GRADE**

A Cast Iron Pipe: CISPI 301, hubless, service weight.
1. Fittings: Cast iron.
2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies. Heavy-Duty (4-band) type only.
3. Pipe and Fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and shall be listed with NSF International.

B PVC Pipe: ASTM D1785 Schedule 40, or ASTM D2241 SDR 26 with not less than 150 psi pressure rating.
1. Fittings: ASTM D2466, PVC.
2. Joints: Solvent welded, with ASTM D2564 solvent cement.
3. Foam Core PVC Piping is not allowed.

**2.04 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING**

A Piping larger than 2 inch: Ductile Iron Pipe: AWWA C151/A21.51.
1. Fittings: Ductile or gray iron, standard thickness.
2. Joints: AWWA C111/A21.11, styrene butadiene rubber (SBR) or vulcanized SBR gasket with 3/4 inch diameter rods.

B Piping 2 inch and smaller: Type K copper, soft drawn
1. ASTM B88 (ASTM B88M)
2. Fittings: ASME B16.22, wrought copper and bronze.
3. Use silver solder on all joints underground.

**2.05 DOMESTIC WATER PIPING, ABOVE GRADE**

A Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
1. Fittings: ASME B16.22, wrought copper and bronze.
2. Use 95-5 solder (95% tin - 5% antimony) on all water piping joints smaller than 2". Use silver solder on piping 2" and larger and on all joints underground.
3. Joints: Grooved mechanical couplings on piping 3" and larger is acceptable
4. Mechanical Press Sealed Fittings: Double-pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.
    a. Manufacturers:
        1) Apollo Valves
        2) Grinnell Products
        3) Viega LLC
        4) Nibco.

**2.06 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING**

A Cast Iron Pipe: ASTM A74 extra heavy weight.
1. Fittings: Cast iron.
2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

B PVC Pipe: ASTM D2665 or ASTM D3034.
1. Fittings: PVC.
2. Joints: Solvent welded, with ASTM D2564 solvent cement.

**2.07 STORM WATER PIPING, ABOVE GRADE**

A Cast Iron Pipe: CISPI 301, hubless, service weight.
1. Fittings: Cast iron.
2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

B PVC Pipe: ASTM D2665 or ASTM D3034.
1. Fittings: PVC.
2. Joints: Solvent welded, with ASTM D2564 solvent cement.

**2.08 CONDENSATE PIPING**

A Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
1. Fittings: ASME B16.22, wrought copper and bronze.

B Cast Iron Pipe: CISPI 301, hubless, service weight.
1. Fittings: Cast iron.
2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies. Heavy-Duty (4-band) type only.

**2.09 NATURAL GAS PIPING, BURIED BEYOND 5 FEET OF BUILDING**

**2.10 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING**

A Steel Pipe: ASTM A53/A53M Schedule 40 black.
1. Fittings: ASTM A234/A234M, wrought steel welding type.
2. Joints: ASME B31.1, welded.
3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

**2.11 NATURAL GAS PIPING, ABOVE GRADE**

A Steel Pipe: ASTM A53/A53M Schedule 40 black.
1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
2. Joints: Threaded or welded to ASME B31.1.

**2.12 FLANGES, UNIONS, AND COUPLINGS**

A No-Hub Couplings:
1. Gasket Material: Neoprene complying with ASTM C564.
2. Band Material: Stainless steel.
3. Eyelet Material: Stainless steel.
4. Must meet CISPI 310 and shall be listed by NSF International.
5. NOTE: Transition fittings from Cast Iron piping to PVC Piping must be FM Approved PVC Transition Fitting specifically deisgned for transition from Cast Iron to PVC - "Band" type transition fittings are not approved.

**2.13 MANUFACTURED SLEEVE-SEAL SYSTEMS**

A Manufacturers:
1. The Metraflex Company
2. Approved Equal

B Modular/Mechanical Seal:
1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
2. Provide watertight seal between pipe and wall/casing opening.
3. Elastomer element size and material in accordance with manufacturer's recommendations.
4. Glass reinforced plastic pressure end plates.

**2.14 PIPING SPECIALTIES**

A Thermostatic Flow Controls (Replacing Circuit Setters): Thermostatic, self-actuating balancing valve that automatically and continuously adjusts the flow of domestic hot water recirculation systems to maintain a specified temperature at the end of each branch.
1. Manufacturers:
   a. Circuit Solver
   b. Acorn
   c. Approved Equal

2. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain
3. Calibration: Device Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.
4. Installation / TAB: During the initial start-up of the Domestic Hot Water System (DHWS), the valve shall be set to wide open and will begin to close once the system temperature requirements are met. System shall be placed into operation and time given for the valves to make the necessary adjustments. BAS Control of Recirculation Pump on and off will not allow the system to properly balance - The specified Aquastat shall be allowed to run Pump On and Off for proper balancing.

**2.15 WATER PRESSURE REDUCING VALVES**

A Manufacturers:
1. Amtrol Inc
2. Apollo Valves
3. Watts Regulator Company
4. Victaulic Series 386 Pressure Reducing Valve Stations

**2.16 RELIEF VALVES**

**2.17 STRAINERS**

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A Verify that excavations are to required grade, dry, and not over-excavated.

**3.02 PREPARATION**

A Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B Remove scale and dirt, on inside and outside, before assembly.
C Prepare piping connections to equipment with flanges or unions.

**3.03 INSTALLATION**

A Install in accordance with manufacturer's instructions.
B Testing of all piping under this contract shall be made in the presence of the Engineer or a designated representative of the Owner. No piping shall be covered or put into operation before such testing has been approved.
C Copper tubing which is out of round will not be acceptable.
D The arrangement of the piping shall follow the general locations shown on the Drawings, such that clearances, line drainages, etc., shall be maintained.
E No notching or mitering of copper tubing will be permitted.
F Joints in Type "K" copper tubing will not be permitted underfloor unless otherwise noted on drawings.
G In pipe chases, the Contractor shall provide for suspension of all piping from the structure. Do not allow piping to rub against masonry when expanding and contracting.
H Close and protect open ends of piping until final connections are made. Such closing shall be made with fittings which cannot be easily removed. Caps or plugs shall be required at all times during construction so that no pipes are left open at the end of any day's work, even though continuation is expected the next day.
I Copper pipe ends shall be reamed, sanded and deburred before soldering. Non-corrosive flux shall be used.
J Any leaky joints shall be remade with new materials. Caulking to make joints tight is absolutely prohibited.
K Sleeves shall be provided wherever pipes pass through walls, floors and ceilings. Sleeves shall be Schedule 40, Black Steel, ½ inch in diameter larger than the pipe or insulation on the pipe. Sleeves through walls and ceiling shall be flush. Sleeves through floors shall extend 1 inch above finished floor. Sleeves installed in exterior walls shall be caulked and made water-tight.
L Pipe joint compound shall be LACO, Hercules, Oatey, or Rector Seal.
M All water piping shall be hydrostatically tested at 150 psig for a period of one hour.
N All piping and equipment installed under this Contract shall be tested in the presence of the Engineer and the proper Plumbing Inspector, and provided tight for the periods stated above, or longer if required by the Inspector. The test shall be administered in sections if deemed advisable.
O No plumbing system or part thereof shall be covered or concealed until after it has been tested and approved. If such work has been covered or concealed before testing, it shall be exposed for testing.

P Provide non-conducting dielectric connections wherever jointing dissimilar metals.

Q Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

R Install piping to maintain headroom, conserve space, and not interfere with use of space.

S Group piping whenever practical at common elevations.

T Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 05 16.

U Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

1. Refer to Section 22 07 19.

V Provide access where valves and fittings are not exposed.

1. Coordinate types, sizes, finish, and locations of Access doors with General Contractor, Other Trades, Owner, and Architect prior to completion of wall and/or ceiling framing in all cases.

W Establish elevations of buried piping outside the building to ensure not less than 2 ft of cover. Provide Additional cover where required by code.

X PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

Y Manufactured Sleeve-Seal Systems:

1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a watertight seal.
6. Install in accordance with manufacturer's recommendations.

**3.04 APPLICATION**

A Where allowed by Piping Material and Type specified, use grooved mechanical couplings and fasteners only in accessible locations.

B Install unions downstream of valves and at equipment or apparatus connections.

C Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

D Install ball or butterfly valves for throttling, bypass, or manual flow control services.

E Provide spring-loaded check valves on discharge of water pumps.

F Provide flow controls in water recirculating systems where indicated.

**3.05 TOLERANCES**

A Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/8" per foot or 1/4 inch per foot slope where indicated in plans and required by code.

B Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

**3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM**

A Prior to starting work, verify system is complete, flushed, and clean.

B Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.

C Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

D Maintain disinfectant in system for 24 hours, after which the system shall be flushed prior to being put into service.

E During the flushing of the system, all flush valves shall be thoroughly flushed out to insure the removal of sediment, pipe dope, etc., from water lines and flush valves, removing such working parts of the flush valves as may be deemed necessary.

F After flushing of the system has been completed, the Contractor shall have water samples taken and delivered to an independent laboratory for testing to show that the water is suitable for drinking. Copies of the laboratory report shall be provided to the Owner and the Engineer. If the State Construction Office is involved, provide form “Water Test Report for Use."

G If final disinfectant residual tests less than 25 mg/L, repeat treatment.

**3.07 DWV SMOKE TEST**

A The final test of the completed drainage and vent systems shall be visual and in sufficient detail to determine compliance with the provisions of the NC Plumbing Code. Where a smoke test is utilized, it shall be made by filling all traps with water and then introducing into the entire system a pungent, thick smoke produced by one or more smoke machines or devices with the appropriate capacity for a system of this size.

B in sufficient detail to determine compliance with the provisions of the NC Plumbing Code. Where a smoke test is utilized, it shall be made by filling all traps with water and then introducing into the entire system a pungent, thick smoke produced by one or more smoke machines or devices with the appropriate capacity for a system of this size. When the

C smoke appears at stack openings on the roof (VTRs), the stack openings shall be closed and a pressure equivalent to a 1-inch water column (248.8 Pa) shall be held on the entire system for a test period of not less than 15 minutes while personnel spread throughout the area of the test observe for visual or olfactory detection of smoke. Where leaks or deficiencies are detected they shall be repaired and the test repeated until owner's and engineer of record's representatives are satisfied that the test has been "passed". Written observations (minutes) of the test shall be documented by the Plumbing Contractor and provided for record with O&M Materials.

D When the smoke appears at stack openings on the roof (VTRs), the stack openings shall be closed and a pressure equivalent to a 1-inch water column (248.8 Pa) shall be held on the entire system for a test period of not less than 15 minutes while personnel spread throughout the area of the test observe for visual or olfactory detection of smoke. Where leaks or deficiencies are detected they shall be repaired and the test repeated until owner's and engineer of record's representatives are satisfied that the test has been "passed".

E Written observations (minutes) of the test shall be documented by the Plumbing Contractor and provided for record with O&M Materials.

**3.08 DWV HYDROSTATIC TESTING**

A Waste and vent piping shall be hydrostatically tested at each floor. A test tee will be installed below each floor and pipe will be filled with water for a height of 10' above finished floor. The pipe shall be gas and watertight. Water shall stand in the system for a period of 30 minutes without evidence of leakage. After the waste and vent piping has been hydrostatically tested for the entire system the piping shall be smoke tested using smoke bombs. The contractor shall plug waste line where it exits building, fill all of the traps with water and test the waste and vent piping by using a smoke bomb in a wall or floor cleanout. He shall install a plug on the cleanout once the smoke bomb has been dropped into the cleanout. The smoke bomb test shall be held for thirty minutes without evidence of leakage in the piping. The smoke bombs for this testing shall be furnished by the contractor. Once the testing of the piping has been completed, the contractor shall flush all of the smoke bombs from the waste piping system

B All piping and equipment installed under this Contract shall be tested in the presence of the Engineer and the proper Plumbing Inspector, and proved tight for the periods stated above, or longer if required by the Inspector

C The final test of the completed drainage and vent systems shall be visual and

D No plumbing system or part thereof shall be covered or concealed until after it has been tested and approved.

E If such work has been covered or concealed before testing, it shall be exposed for testing

F After the pipe is installed, tested and inspected, backfill shall be installed and compacted. Backfill material shall conform to ASTM D-2371 Soil Class III. Backfill shall be installed, compacted and tested in 6” layers up to 12” above top of pipe. Backfill shall continue in 12” layers to finished grade

**3.09 DWV UNDERGROUND CAMERA INVESTIGATION**

A The entire underground waste piping system shall be videoed and recorded by the Contractor on an audible CD/DVD to ensure that the Owner knows the location of the piping being viewed. The recorded CD/DVD shall be provided to the Engineer of Record and the Owner's Project Manager three (3) weeks prior to Substantial Completion inspection. The Substantial Completion inspection cannot occur until the video has been reviewed and all the underground waste piping system has been approved by the Engineer in Record.

**3.10 SCHEDULES**

A Pipe Hanger Spacing:

1. Metal Piping:

a. Pipe Size: 1/2 inches to 1-1/4 inches:
   1) Maximum Hanger Spacing: 6.5 ft.
   2) Hanger Rod Diameter: 3/8 inches.
b. Pipe Size: 1-1/2 inches to 2 inches:
   1) Maximum Hanger Spacing: 10 ft.
   2) Hanger Rod Diameter: 3/8 inch.
c. Pipe Size: 2-1/2 inches to 3 inches:
   1) Maximum Hanger Spacing: 10 ft.
   2) Hanger Rod Diameter: 1/2 inch.
d. Pipe Size: 4 inches to 6 inches:
   1) Maximum Hanger Spacing: 10 ft.
   2) Hanger Rod Diameter: 5/8 inch.
e. Pipe Size: 8 inches to 12 inches:
   1) Maximum hanger spacing: 14 ft.
   2) Hanger Rod Diameter: 7/8 inch.

2. Plastic Piping:
   a. All Sizes:
      1) Maximum Hanger Spacing: 6 ft.
      2) Hanger Rod Diameter: 3/8 inch.
3. Install hangers for PEX tubing in strict accordance with manufactures instructions.

**END OF SECTION 22 10 05**

# SECTION 22 10 06
# PLUMBING PIPING SPECIALTIES

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Drains
B Cleanouts
C Hose bibbs
D Hydrants
E Washing machine boxes and valves
F Refrigerator valve and recessed box
G Back water valves
H Backflow preventers
I Double check valve assemblies
J Water hammer arrestors
K Mixing valves

### 1.02 REFERENCE STANDARDS

A ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
B ASME A112.6.3 - Floor Drains; 2022.
C ASME A112.6.4 - Roof, Deck, and Balcony Drains; 2022.
D ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers; 2023.
E NSF 61 - Drinking Water System Components - Health Effects; 2022, with Errata.
F NSF 372 - Drinking Water System Components - Lead Content; 2022.
G PDI-WH 201 - Water Hammer Arresters; 2017.

### 1.03 SUBMITTALS

A Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
B Certificates: Certify that grease interceptors meet or exceed specified requirements.
C Operation Data: Indicate frequency of treatment required for interceptors.
D Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors, access panels.
E Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. Extra Loose Keys for Outside Hose Bibbs: One.
    2. Extra Hose End Vacuum Breakers for Hose Bibbs: One.

### 1.04 QUALITY ASSURANCE

A Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than five years documented experience.

### 1.05 DELIVERY, STORAGE, AND HANDLING

A Accept specialties on site in original factory packaging. Inspect for damage.

## PART 2 PRODUCTS

### 2.01 GENERAL REQUIREMENTS

A Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

### 2.02 DRAINS

A Manufacturers:
    1. Jay R. Smith Manufacturing Company; _____: www.jayrsmith.com/#sle.
    2. Josam Company; _____: www.josam.com/#sle.
    3. Zurn Industries, LLC; _____: www.zurn.com/#sle.
B Roof Drains:
    1. Assembly: ASME A112.6.4.
    2. Body: Lacquered cast iron with sump.
    3. Strainer: Removable polyethylene dome with vandal proof screws.
    4. Manufacturers:
        a. Jay R. Smith Manufacturing Company; _____: www.jrsmith.com/#sle.

b. Menzies Metal Products; Clamp-Tite Spun Aluminum Drain (Small Bowl): www.menzies-metal.com/#sle.
c. MIFAB, Inc; _____: www.mifab.com/#sle.

C Floor Drains:
1. Manufacturers:
a. ACO, Inc; _____: www.acobuildingdrainage.us/#sle.
b. Jay R. Smith Manufacturing Company; _____: www.jrsmith.com/#sle.
c. MIFAB, Inc; _____: www.mifab.com/#sle.

D Floor Drain (FD-1):
1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.

E Floor Drain (FD-2):
1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable round nickel bronze strainer with removable perforated sediment bucket.

F Floor Drain (FD-3):
1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer with polished bronze funnel or anti-splash rim.

G Floor Drain (FD-4):
1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze extra heavy duty strainer.

**2.03 CLEANOUTS**

A Manufacturers:
1. Jay R. Smith Manufacturing Company; _____: www.jayrsmith.com/#sle.
2. Josam Company; _____: www.josam.com/#sle.
3. MIFAB, Inc; _____: www.mifab.com/#sle.
4. Zurn Industries, LLC; _____: www.zurn.com/#sle.

B Cleanouts at Exterior Surfaced Areas (CO-1):
1. Round cast nickel bronze access frame and non-skid cover.

C Cleanouts at Exterior Unsurfaced Areas (CO-2):
1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.

D Cleanouts at Interior Finished Floor Areas (CO-3):
1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

**2.04 HOSE BIBBS**

A Manufacturers:
1. Jay R. Smith Manufacturing Company; _____: www.jayrsmith.com/#sle.
2. Watts Regulator Company; _____: www.wattsregulator.com/#sle.
3. Zurn Industries, LLC; _____: www.zurn.com/#sle.

B Interior Hose Bibbs:
1. Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with handwheel, integral vacuum breaker in compliance with ASSE 1011.

C Interior Mixing Type Hose Bibbs:
1. Bronze or brass, wall mounted, double service faucet with hose thread spout, integral stops, chrome plated where exposed with handwheels, and vacuum breaker in compliance with ASSE 1011.

**2.05 WASHING MACHINE BOXES AND VALVES**

A Box Manufacturers:
1. Oatey Supply Chain Services, Inc; _____: www.oatey.com/#sle.

B Valve Manufacturers:

**2.06 REFRIGERATOR VALVE AND RECESSED BOX**

A Box Manufacturers:
1. Oatey Supply Chain Services, Inc; _____: www.oatey.com/#sle.

**2.07 BACK WATER VALVES**

A Manufacturers:
1. Jay R. Smith Manufacturing Company; _____: www.jayrsmith.com/#sle.
2. Savko Plastic Pipe & Fittings, Inc; _____: www.savko.com/#sle.
3. Zurn Industries, LLC; _____: www.zurn.com/#sle.

**2.08 BACKFLOW PREVENTERS**

A Manufacturers:
1. Apollo Valves; _____: www.apollovalves.com/#sle.
2. MIFAB, Inc; _____: www.mifab.com/#sle.
3. Watts Regulator Company, a part of Watts Water Technologies; _____: www.wattsregulator.com/#sle.
4. Zurn Industries, LLC; _____: www.zurn.com/#sle.

**2.09 DOUBLE CHECK VALVE ASSEMBLIES**

A Manufacturers:
1. Apollo Valves; _____: www.apollovalves.com/#sle.
2. Watts Regulator Company, a part of Watts Water Technologies; _____: www.wattsregulator.com/#sle.
3. Zurn Industries, LLC; _____: www.zurn.com/#sle.

**2.10 WATER HAMMER ARRESTORS**

A Manufacturers:
1. Cash Acme, a brand of Reliance Worldwide Corporation
2. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
3. Watts Regulator Company, a part of Watts Water Technologies
4. Zurn Industries, LLC

B Water Hammer Arrestors:
1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F and maximum 250 psi working pressure.

**2.11 RELIEF VALVES**

A Manufacturers:
1. Cash Acme, a brand of Reliance Worldwide Corporation; _____: www.cashacme.com/#sle.
2. ITT Bell & Gossett; _____: www.bellgossett.com/#sle.

B Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A Install in accordance with manufacturer's instructions.

B Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C Encase exterior cleanouts in concrete flush with grade.

D Install floor cleanouts at elevation to accommodate finished floor.

E Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.

F Pipe relief from backflow preventer to nearest drain.

G Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatory sinks, washing machine outlets, or _____.

H Install air chambers on hot and cold water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or 3/4 inch minimum, and minimum 18 inches long.

**END OF SECTION 22 10 06**

**SECTION 22 11 23**
**DOMESTIC WATER PUMPS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Circulators.

### 1.02 RELATED REQUIREMENTS

A Section 22 05 13 - Common Motor Requirements for Plumbing Equipment.
B Section 25 15 00 - Integrated Automation Software.
C Section 26 05 83 - Wiring Connections.

## PART 2 PRODUCTS

### 2.01 CIRCULATORS

A Manufacturers:
1. Armstrong Fluid Technology; _____: www.armstrongfluidtechnology.com/#sle.
2. Bell & Gossett, a Brand of Xylem, Inc; _____: www.xylem.com/#sle.
3. Taco, Inc; _____: www.tacocomfort.com/#sle.

B Casing: Bronze with bronze cast impeller, and stainless steel rotor assembly.
C Shaft: Alloy steel with integral thrust collar and two oil-lubricated bronze sleeve bearings.
D Mechanical Seal: Carbon rotating against a stationary ceramic seat.
E Pipe-End Connection: Union connection.
F Maximum Discharge Pressure: 145 psi.
G Motor: 1,750 rpm, ECM duty with flexible coupling.
H Service Temperature Range: Minus 30 to 250 degrees F.
I Controls: Provide aquastat set for high-temp cutoff, electric plug, and illuminated hand switch.

**END OF SECTION 22 11 23**

# SECTION 22 30 00
# PLUMBING EQUIPMENT

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Water Heaters:
1. Commercial gas fired.
2. Commercial electric.

B Packaged water heating systems.
C Domestic water heat exchangers.
D Domestic hot water storage tanks.
E Diaphragm-type compression tanks.
F Reverse osmosis equipment.
G Deionization equipment.
H In-line circulator pumps.
I Pressure booster systems.
J Sewage ejectors.

### 1.02 REFERENCE STANDARDS

A ANSI Z21.10.1 - Gas Water Heaters, Volume I, Storage Water Heaters with Input Ratings of 75,000 Btu Per Hour or Less; 2019, with Errata (2020).
B ANSI Z21.10.3 - Gas-Fired Water Heaters, Volume III, Storage Water Heaters with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous; 2019.
C ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2023.
D NEMA MG 1 - Motors and Generators; 2021.
E NFPA 31 - Standard for the Installation of Oil-Burning Equipment; 2020, with Amendment (2023).
F NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
G UL 174 - Standard for Household Electric Storage Tank Water Heaters; Current Edition, Including All Revisions.
H UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.
I UL 1453 - Standard for Electric Booster and Commercial Storage Tank Water Heaters; Current Edition, Including All Revisions.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
B Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

### 1.04 SUBMITTALS

A See Section 01 30 00 - Administrative Requirements, for submittals procedures.
B Product Data:
1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
2. Indicate pump type, capacity, power requirements.
3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
4. Provide electrical characteristics and connection requirements.

C Project Record Documents: Record actual locations of components.
D Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
E Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
F Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Extra Pump Seals: One of each type and size.

**1.05 QUALITY ASSURANCE**

A Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum ten years of documented experience.

B Certifications:

1. Water Heaters: NSF approved.
2. Gas Water Heaters: Certified by CSA International to ANSI Z21.10.1, as applicable, in addition to requirements specified elsewhere.
3. Electric Water Heaters: UL listed and labeled to UL 174.
4. Oil-Fired Water Heaters: To NFPA 31.
5. Pressure Vessels for Heat Exchangers: ASME labeled to ASME BPVC-VIII-1.
6. Water Tanks: ASME labeled to ASME BPVC-VIII-1.
7. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

C Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

D Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

E ASME STAMP: All Boilers, Water Heaters, and/or Pressure Vessels and their components shall bear the ASME Stamp and where applicable shall bear the ASME HLW stamp.

**1.06 DELIVERY, STORAGE, AND HANDLING**

A Provide temporary inlet and outlet caps. Maintain caps in place until installation.

**1.07 WARRANTY**

A See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B Provide seven year manufacturer warranty for domestic water heaters.

**PART 2 PRODUCTS**

**2.01 WATER HEATERS**

A Manufacturers:

1. A.O. Smith Water Products Co
2. Bock Water Heaters, Inc
3. Rheem Manufacturing Company
4. State Water Heater
5. Tankless - Stiebel Eltron, Chronomite, Navien, Lochinvar
6. Bradford-White
7. LAARS
8. Substitutions: Not permitted.

B Commercial Gas Fired:

1. Type: Automatic, natural gas-fired, vertical storage.
2. Performance:
   a. Energy Factor: see fixture schedule.
   b. Storage Capacity: see fixture schedule gal.
   c. First Hour Rating: see fixture schedule gal.
   d. Input: see fixture schedule Btuh at sea level.
   e. Minimum Recovery Rate: see fixture schedule gph with 100 degrees F temperature rise.
   f. Maximum Working Pressure: 150 psig.
3. Tank: Glass-Lined, Duplex Alloy, Nickel-Plated, or approved lining, welded steel ASME labeled; multiple flue passages, 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.
4. Accessories:
   a. Water Connections: Brass.
   b. Dip Tube: Brass.
   c. Drain valve.

d. Anode: By Manufacturer.
e. Temperature and Pressure Relief Valve: ASME labeled.

5. Certified For The Following Applications:
   a. Automatic storage water heater.
   b. Automatic circulating tank water heater.
   c. For operation at 180 degrees F.
   d. For operation on combustible floors.
6. Controls: Automatic direct immersion thermostat with temperature range adjustable minimum 175 degrees F differential, automatic reset high temperature limiting thermostat factory set at 195 degrees F, gas pressure regulator, multi-ribbon or tubular burner, 100 percent safety shut-off pilot and thermocouple, intermittent electronic ignition monitoring pilot and main flame, trial for re-ignition for momentary loss of flame, shutdown of pilot and main burner in "2 to 4" seconds after loss of flame, and automatic flue damper.

C Commercial Electric:

1. Type: Factory-assembled and wired, electric, vertical storage.
2. Performance:
   a. Energy Factor: see fixture schedule.
   b. Storage Capacity: see fixture schedule gal.
   c. First Hour Rating: see fixture schedule gal.
   d. Heating Element Size: see fixture schedule kW.
   e. Number of Heating Elements: see fixture schedule.
   f. Minimum Recovery Rate: see fixture schedule gph with 100 degrees F temperature rise.
   g. Maximum Working Pressure: 150 psig.
3. Electrical Characteristics:
   a. see fixture schedule volts, single phase, 60 Hz.
   b. see fixture schedule amperes maximum fuse size.
4. Tank: glass lined, duplex alloy, nickel plating, or approved lining welded steel; 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber encased in corrosion-resistant steel jacket; baked-on enamel finish.
5. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60 to 180 degrees F, flanged or screw-in nichrome elements, high temperature limit thermostat.
6. Accessories:
   a. Water Connections: Brass.
   b. Dip Tube: By Manufacturer.
   c. Drain valve.
   d. Anode: By Manufacturer.
   e. Temperature and Pressure Relief Valve: ASME labeled.
7. Controls: Ventilated control cabinet, factory-wired with solid state progressive sequencing step controller, fuses, magnetic contactors, control transformer, pilot lights indicating main power and heating steps, control circuit toggle switch, electronic low-water (probe-type) cut-off, high temperature limit thermostat, flush-mounted temperature and pressure gauges.
8. Heating Elements: Flange-mounted immersion elements; individual elements sheathed with Incoloy corrosion-resistant metal alloy, rated less than 75 W/sq in.

## 2.02 DOMESTIC HOT WATER STORAGE TANKS

A Manufacturers:

1. Tanks shall be by same manufacturer of water heaters where possible - submitted tanks from different manufacturers will be reviewed on a case by case basis assuming water heater manufacturer selected does not also make tanks.

B Tank: Welded steel, ASME labeled for working pressure of 125 psig, steel support saddles, tappings for accessories, threaded connections of stainless steel, access manhole.

C Openings: Up to 3 inches, copper-silicone threaded; over 4 inches, flanged; flanged collar for heat exchanger; manway fitting.

D Accessories: Tank drain, water inlet and outlet, thermometer range of 40 to 200 degrees F, ASME pressure relief valve suitable for maximum working pressure.

**2.03 DIAPHRAGM-TYPE COMPRESSION TANKS**

A Manufacturers:
1. Amtrol Inc: www.amtrol.com/#sle.
2. Bell & Gossett, a xylem brand: www.bellgossett.com/#sle.
3. Taco, Inc: www.taco-hvac.com/#sle.
4. Watts.
5. Substitutions: Not permitted.

B Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.

C Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 12 psig.

**2.04 IN-LINE CIRCULATOR PUMPS**

A Manufacturers:
1. Armstrong Fluid Technology: www.armstrongfluidtechnology.com/#sle.
2. Bell & Gossett, a xylem brand: www.bellgossett.com/#sle.
3. Taco.
4. Grundfos
5. Substitutions: Not permitted.

B Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.

C Impeller: Bronze.

D Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.

E Seal: Carbon rotating against a stationary ceramic seat.

F Drive: Flexible coupling.

G Performance:

**2.05 ELECTRICAL WORK**

A Provide electrical motor driven equipment specified complete with motors, motor starters, controls, and wiring.

B Electrical characteristics to be as specified or indicated.

C Furnish motor starters complete with thermal overload protection and other appurtenances necessary for the motor control specified.

D Supply manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices not shown.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B Coordinate with plumbing piping and related fuel piping work to achieve operating system.

C Domestic Water Storage Tanks:
1. Provide steel pipe or concrete pad support, independent of building structural framing members.
2. Clean and flush prior to delivery to site. Seal until pipe connections are made.

D Pumps:
1. Ensure shaft length allows sump pumps to be located minimum 24 inches below lowest invert into sump pit and minimum 6 inches clearance from bottom of sump pit.
2. Provide air cock and drain connection on horizontal pump casings.
3. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.
4. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and over.

5. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
6. Align and verify alignment of base mounted pumps prior to start-up

**END OF SECTION 22 30 00**

# SECTION 22 40 00
# PLUMBING FIXTURES

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Water closets
B Urinals
C Lavatories
D Sinks
E Service sinks
F Mop sinks.
G Under-lavatory pipe supply covers.
H Electric water coolers
I Showers
J Eye and face wash fountains
K Emergency showers

### 1.02 REFERENCE STANDARDS

A ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
B ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment; 2014.
C ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017).
D ASME A112.18.1 - Plumbing Supply Fittings; 2018, with Errata.
E ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011 (Reaffirmed 2022).
F ASME A112.19.1 - Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures; 2018.
G ASME A112.19.2 - Ceramic Plumbing Fixtures; 2018, with Errata.
H ASME A112.19.3 - Stainless Steel Plumbing Fixtures; 2022.
I ASME A112.19.4M - Porcelain Enameled Formed Steel Plumbing Fixtures; 1994 (Reaffirmed 2009).
J ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2022.
K ASME A112.19.14 - Six-Liter Water Closets Equipped with a Dual Flushing Device; 2013 (Reaffirmed 2018).
L ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2020.
M ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023c.
N IAPMO Z124 - Plastic Plumbing Fixtures; 2022, with Editorial Revision.
O ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
P ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
Q NSF 61 - Drinking Water System Components - Health Effects; 2022, with Errata.
R NSF 372 - Drinking Water System Components - Lead Content; 2022.

### 1.03 SUBMITTALS

A Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

### 1.04 DELIVERY, STORAGE, AND HANDLING

A Accept fixtures on site in factory packaging only. Inspect for damage.
B Protect products from damage while transporting, handling, or in storage.
C Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

## PART 2 PRODUCTS

### 2.01 GENERAL REQUIREMENTS

A Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

### 2.02 FLUSH VALVE WATER CLOSETS

A Water Closets: Vitreous china, ASME A112.19.2,siphon jet flush action, china bolt caps.
1. Manufacturers:

a. American Standard, Inc
b. Zurn Industries, Inc
c. Toto
d. Sloan

B Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
1. Sensor-Operated Type: Solenoid operator, normal voltage or battery as indicated in fixture schedule, infrared sensor with mechanical over-ride or over-ride push button.
2. Concealed Type: Rough brass, exposed parts chrome plated, wall escutcheon, wheel handle stop.
3. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.
4. Metering Type: Easily accessible adjustment nut.
5. Manufacturers:
a. Hydrotek:
b. Delany Products:
c. Sloan Valve Company:
d. Zurn Industries, Inc:

C Seats:
1. Manufacturers:
a. American Standard, Inc
b. Bemis Manufacturing Company
c. Church Seat Company
d. Olsonite: www.olsonite.com/#sle.
e. Zurn Industries, Inc
2. Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, without cover unless otherwise specified in fixture schedule.

D Water Closet Carriers:
1. Manufacturers:
a. JOSAM Company; _____: www.josam.com/#sle.
b. Zurn Industries, Inc; _____: www.zurn.com/#sle.
c. JR Smith_____.
d. Watts
2. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

**2.03 WALL HUNG URINALS**

A Wall Hung Urinal Manufacturers:
1. American Standard, Inc
2. Zurn
3. Sloan
4. Toto

B Urinals: Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.
1. Flush Volume: 0.125 gallons, maximum.
2. Flush Valve: Exposed (top spud).
3. Flush Operation: Sensor operated.
4. Trap: Integral.
5. Supply Size: 3/4 inch.
6. Outlet Size: 2 inches.

C Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
1. Sensor-Operated Type: Solenoind or motor-driven operator, low voltage hard-wired, infrared sensor with mechanical over-ride or over-ride push button.
2. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.

D Carriers:
1. Manufacturers:
a. Jay R. Smith MFG. Co; _____: www.jrsmith.com/#sle.

b. JOSAM Company; _____: www.josam.com/#sle.
c. Zurn Industries, Inc; _____: www.zurn.com/#sle.

2. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

**2.04 LAVATORIES**

A Lavatory Manufacturers:
1. American Standard, Inc; _____: www.americanstandard-us.com/#sle.
2. Kohler Company; _____: www.kohler.com/#sle.
3. Zurn Industries, Inc; _____: www.zurn.com/#sle.

B Vitreous China Wall Hung Basin: ASME A112.19.2; vitreous china wall hung lavatory, ___ by ___ inch minimum, with 4 inch high back, rectangular basin with splash lip, front overflow, and soap depression.
1. Drilling Centers: 4 inch.

C Supply Faucet Manufacturers:
1. Kohler Company: www.kohler.com/#sle.
2. Zurn Industries, Inc: www.zurn.com/#sle.

D Supply Faucet: ASME A112.18.1; chrome plated combination supply fitting with pop-up waste, water economy aerator with maximum flow of 2.2 gallons per minute, indexed handles.

**2.05 WALL-HUNG MULTI-STATION LAVATORY UNITS - SOLID SURFACE**

A Description: Rectilinear, level-surface deck, seamless and integral elongated basin, with stainless steel enclosed pedestal cabinet.

B Deck and Bowl Material: Fabricate from molded engineered stone material consisting of natural quartz, granite, and other minerals in a matrix of thermoset acrylic modified bio-based polyester resin and meeting requirements of IAPMO Z124.

C Surface Burning Characteristics: Smoke developed index less than 450, and flame spread index less than 25, Class A, when tested in accordance with ASTM E84.

D Unit Length: _____ inches.

E Soap Dispenser:

F Color: As selected by Architect from manufacturer's full line.

G Faucet Drilling: 4 inch (100 mm) centerset drilling.

H Sensor-Operated Faucets:
1. High profile metering faucet with infrared and external temperature control.
2. Vandal-resistant meeting requirements of ASME A112.18.1 and ADA Standards compliant.
3. Body: Polished chrome plated commercial solid cast brass, with 4 inch (102 mm) centerset mounting with anti-rotation trim plate.
4. Tempered Water Supply: ADA Standards compliant lever on faucet body.
5. Aerator: Flow rate of 0.5 gal/min at an operating range of 20 to 80 psi.
6. Sensor Module: Water conserving, vandal-resistant adjustable sensor unit with timing turn-off delay and stationary object automatic timed cutoff, with battery diagnostic light, serviceable from above deck.
7. Power Supply: Battery-operated single faucet with 6V lithium battery and single 115 VAC plug-in adapter.
8. Thermostatic Mixing Valve: Thermostatic mixing valve, ASSE 1070 listed, with combination stop, strainer, and check valves, and flexible stainless steel connectors.

I Access Panel: Stainless steel.

**2.06 SINKS**

A Sink Manufacturers:
1. American Standard, Inc; _____: www.americanstandard-us.com/#sle.
2. Kohler Company; _____: www.kohler.com/#sle.
3. (See fixture schedule).

B Single Compartment Bowl: ASME A112.19.3; _____ by _____ by _____ inch outside dimensions 20 gage, 0.0359 inch thick, Type 302 stainless steel, self rimming and undercoated, with ledge back drilled for trim.
1. Drain: 1-1/2 inch chromed brass drain.

**2.07 UNDER-LAVATORY PIPE SUPPLY COVERS**

A Manufacturers:
1. Plumberex Specialty Products, Inc; _____: www.plumberex.com/#sle.

B General:
1. Insulate exposed drainage piping including hot, cold and tempered water supplies under lavatories or sinks per ADA Standards.
2. Construction: 1/8 inch PVC with antimicrobial, antifungal and UV resistant properties.
   a. Comply with ASME A112.18.9 for covers on accessible lavatory piping.
   b. Comply with ICC A117.1.

**2.08 SHOWERS**

A Shower Manufacturers:
1. American Standard, Inc; _____: www.americanstandard-us.com/#sle.
2. Aqua Glass Corporation; _____: www.aquaglass.com/#sle.
3. Kohler Company; _____: www.kohler.com/#sle.
4. Symmons (see fixture schedule)

**2.09 ELECTRIC WATER COOLERS**

A Electric Water Cooler Manufacturers:
1. Elkay Manufacturing Company; _____: www.elkay.com/#sle.
2. Haws Corporation; _____: www.hawsco.com/#sle.

B Water Cooler: Electric, mechanically refrigerated; surface mounted, ADA compliant; stainless steel top, vinyl on steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket; integral air cooled condenser and stainless steel grille.
1. Capacity: 8 gallons per hour of 50 degrees F water with inlet at 80 degrees F and room temperature of 90 degrees F, when tested in accordance with ASHRAE Std 18.
2. Electrical: 115 V, 60 Hertz compressor, 6 foot cord and plug for connection to electric wiring system including grounding connector.

C Bottle Filler: Materials to match fountain.

**2.10 BI-LEVEL, ELECTRIC WATER COOLERS**

A Bi-level, Electric Water Cooler Manufacturers:
1. Elkay Manufacturing Company; _____: www.elkay.com/#sle.
2. Haws Corporation; _____: www.hawsco.com/#sle.

B Water Cooler: Bi-level, electric, mechanically refrigerated; surface mounted, ADA compliant; stainless steel top, vinyl on steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket; integral air cooled condenser and stainless steel grille.
1. Capacity: 8 gallons per hour of 50 degrees F water with inlet at 80 degrees F and room temperature of 90 degrees F, when tested in accordance with ASHRAE Std 18.
2. Electrical: 115 V, 60 Hertz compressor, 6 foot cord and plug for connection to electric wiring system including grounding connector.

C Bottle Filler: Materials to match fountain.

**2.11 MOP SINKS**

A Mop Sink Manufacturers:
1. Just Manufacturing Company; _____: www.justmfg.com/#sle.
2. Zurn Industries, Inc; _____: www.zurn.com/#sle.

B Tiling Flange Construction: Galvanized steel.

C Dimensions: As indicated on drawings.

D Terrazzo Mop Sink Manufacturers:

**2.12 SERVICE SINKS**

A Service Sink Manufacturers:
1. American Standard, Inc; _____: www.americanstandard-us.com/#sle.
2. Elkay Manufacturing Company; _____: www.elkay.com/#sle.
3. Just Manufacturing Company; _____: www.justmfg.com/#sle.
4. Zurn Industries, Inc; _____: www.zurn.com/#sle.

5. FIAT (see fixture schedule).

**2.13 EMERGENCY EYE AND FACE WASH**

A Emergency Wash Manufacturers:
1. Bradley.
2. Guardian
3. Haws
4. Speakman
5. Approved Equal

B Emergency Wash: ANSI Z358.1; wall-mounted, self-cleaning, non-clogging eye and face wash with quick opening, full-flow valves, stainless steel eye and face wash receptor, twin eye wash heads and face spray ring, stainless steel dust cover, copper alloy control valve and fittings.

**2.14 EMERGENCY SHOWERS**

A Emergency Shower Manufacturers:
1. Bradley.
2. Guardian
3. Haws
4. Speakman
5. Approved Equal

B Emergency Shower: ANSI Z358.1; wall-mounted, self- cleaning, non-clogging 8 inch diameter stainless steel deluge shower head with elbow, one inch full flow valve with pull chain and 8 inch diameter ring, one inch interconnecting fittings.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B Verify that electric power is available and of the correct characteristics.

C Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

**3.02 PREPARATION**

A Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in / connection schedule found in the drawings for particular fixtures unless piping sizes are otherwise noted on plans and/or risers in drawings.

**3.03 INSTALLATION**

A Install each fixture with trap, easily removable for servicing and cleaning.

B Provide chrome plated rigid supplies to fixtures with loose key stops, reducers, and escutcheons. Stainless Steel Flexible supplies may be used only when previously approved by the engineer or where specified in drawings.

C Install fixtures and components level and plumb.

D Install and secure fixtures in place according to manufacturer's recommendations with fixture manufacturer's supplied wall supports and bolts where required and unless otherwise stated in drawings.

E Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

F All plumbing fixtures, with the exception of Electric Water Coolers, shall be neatly caulked to the wall or floor with paintable white silicone caulking compound. Countertop lavatories shall be caulked watertight.

**3.04 INTERFACE WITH WORK OF OTHER SECTIONS**

A Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation. Notify Engineer of conflicts or discrepancies prior to the start of work.

**3.05 ADJUSTING**

A Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

**3.06 CLEANING**

A Thoroughly Clean all plumbing fixtures and equipment.

**3.07 PROTECTION**

A Protect installed products from damage due to subsequent construction operations.

B Do not permit use of fixtures by construction personnel.

C Repair or replace damaged products before Date of Substantial Completion.

**END OF SECTION 22 40 00**

# SECTION 23 01 00
# HVAC GENERAL PROVISIONS

## PART 1 GENERAL

### 1.01 SCOPE OF WORK

A The Contractor shall provide all materials, equipment and labor necessary to install and set into operation the heating and air conditioning equipment as shown on the Engineering Drawings and as contained herein.

B Intent of the drawings and specifications is to obtain complete systems, tested, adjusted, and ready for operation.

C Include incidental details not usually indicated or specified, but necessary for proper installation and operation.

### 1.02 QUALITY ASSURANCE

A Refer to the General and Supplementary General Conditions and Division 01.

B Check, verify, and coordinate work with drawings and specifications of other trades. Include modifications, relocations, and adjustments necessary to complete work or to avoid interference with other trades.

C All work shall be in accordance with local, state and federal regulations. Minimum requirements shall be the North Carolina State Building Code.

D The Contractor shall be responsible for obtaining all permits and shall notify inspection departments as work progresses.

E Whenever the words "Approval", "Approved", or "Approved Equal" appear, it is intended that items other than the model number specified shall be subject to the approval of the engineer.

F Where a submitted product has electrical requirements that differ from the Basis of Design specified product, it is the Mechanical Contractor's responsibility to coordinate the electrical requirements of the equipment with the Electrical Engineer and Electrical Contractor at no additional cost to the project.

G All material and equipment that the Contractor proposed to substitute in lieu of those specified in the Specifications, shall be submitted to the Engineer ten (10) days prior to the bid date for evaluation. The submittal shall include a full description of the material or equipment and all pertinent engineering data required to substantiate the equality of the proposed item to that specified. Items that are submitted for approval after this date will not be accepted.

H "Provide" as used herein shall mean that the Contractor responsible shall furnish and install said item or equipment. "Furnish" as used herein shall mean that the Contractor responsible shall acquire and make available said item or equipment and that installation shall be by others. "Install" as used herein shall mean that the Contractor responsible shall make installation of items or equipment furnished by others.

### 1.03 REQUIREMENT OF REGULATORY AGENCIES

A Rules and regulations of Federal, State, and local authorities having jurisdiction, and utility companies, in force at time of execution of contract shall become part of this specification.

### 1.04 SUBSTITUTIONS

A Products are specified for use on this project by one of the following:

1. Reference Standards and Description: Any products meeting the Reference Standards and Description will be acceptable (i.e., piping).
2. Naming of a product as an example to denote the quality standard of the product desired, in which case three or more brands will be denoted (where applicable) to establish equivalent designs. Naming of a product does not restrict Bidders to a specific brand (i.e., fixtures, valves, etc.).
3. Requests for approval of manufacturer's or substitutions which have not been preapproved shall be made by using the forms at the end of this section.

B During bidding period: Submitted written requests from Bidders Only, using the forms herein, will be considered if received ten (10) calendar days prior to the date of receipt of bids to allow for proper evaluation. Requests from suppliers or subcontractors will not be considered. Substitutions will be considered when a product becomes unavailable through no fault of the Contractor. A request constitutes a representation that the Bidder/Contractor:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product and is suitable for use in the Work.
2. Will provide the same warranty for the substitution as for the specified product.

3. Will coordinate installation and make changes to other work which may be required for the work to be complete with no additional cost to the Owner.
4. Waives claims for additional cost or time extension which may subsequently become apparent.
5. Has included a list of similar projects on which this product has been used with names and telephone numbers for verification.
6. Has written verification from the product manufacturer that this product has been in use a minimum of two (2) years on a project similar to this work.
7. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

C Architect/Engineer Review
1. Review and approval will rely on manufacturer's literature and other data as outlined herein.
2. Inadequacies in such submittals that fail to identify unsuitability are the responsibility of the parties making submittal.

D Substitution Procedure
1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence.
3. Submit listing of similar projects.
4. Submit manufacturer's written verification that product has been in use a minimum of two (2) years at similar projects.
5. The Architect/Engineer will notify Contractor, in writing, of decision to accept or reject request.
6. Products bid or incorporated in the work that are not specified and without written approval of the Architect/Engineer may not be acceptable, and if not, the Contractor will be required to furnish and install the products specified.
7. The Architect/Engineer will issue written approvals of product substitutions to all Bidders. Substitutions are not approved without written approval.
8. FORMS: Copy forms incorporated at the end of this section and use for all product substitution requests.

**1.05 SUBMITTALS**

A Refer to General and Supplementary General Conditions and Division 01.

B For satisfying submittal requirements for Division 23, "Product Data" is usually more appropriate than true "Shop Drawings" as defined in Division 01. However, the term "Shop Drawings" may be used throughout the specifications.

C Within ten days after notification of the award of the Contract and written notice to begin work, the Contractor shall submit to the Architect/Engineer for approval a detailed list of equipment and material which he proposes to use. Items requiring submittal data for approval will be noted at this time.

D Mark general catalog sheets and drawings to indicate specific items submitted and their correlation to specific tagged equipment on the drawings. Cross out all nonapplicable or extraneous information that does not apply to the submitted equipment. Circle or otherwise clearly indicate applicable options.

E Contractor shall clearly indicate deviations (if any) from the project specifications on each submittal. Shop drawings accepted by the Engineer shall not relieve the Contractor of their responsibility to construct the work in accordance with the Contract Documents.

F Include proper identification of equipment or item by name and/or number, as indicated on the Drawings.

G Where manufacturer's reference numbers differ from those specified, clearly indicate such on the submittal.

H Where equipment or items specified include accessories, parts, and additional items under one designation, submittals shall be complete and include all required components.

I Equipment requiring electrical connections shall include composite wiring diagrams, motor efficiency, and power factor data. Wiring diagrams submitted shall be specific to project conditions.

J Where submittals cover products containing non-metallic materials, include MSDS sheets from the manufacturer stating physical and chemical properties of components and precautionary steps to be taken.

K The Contractor shall provide an electronic PDF copy of submittal data. The pdf shall contain complete submittal data on all products, methods, etc. proposed for use on the project.

L Each submittal shall bear the approval of the Contractor indicating that he has reviewed the data and found it to meet the requirements of the specifications as well as space limitations and other project conditions. The submittals shall be clearly identified showing project name, manufacturer's catalog number, and all necessary performance and fabrication data.

M The Contractor shall submit to the Engineer a set of accurately marked up plans indicating all changes encountered during the construction. Final payment will be contingent on receipt of these as-built plans.

N The Contractor shall furnish an electronic PDF copy of maintenance and operating instructions as outlined in Paragraph C (Execution), of this specification section.

O The Contractor shall submit to the Owner all certificates required for operating system in compliance with local, state and federal regulations.

**1.06 PRODUCT DELIVERY, STORAGE AND HANDLING**

A All material and equipment shall be delivered and unloaded by the Contractor within the project site as noted herein or as directed by the Owner.

B The Contractor shall protect all material and equipment from breakage, theft, or weather damage. No material or equipment shall be stored on the ground.

C The material and equipment shall remain the property of the Contractor until the project has been completed and turned over to the Owner.

**1.07 WORK CONDITIONS AND COORDINATION**

A The Contractor shall review the electrical plans to establish points of connection and the extent of electrical work to be provided in his Contract. All electrical work shall be performed by a licensed electrical contracting firm.

B This Contractor shall be responsible for the final electrical connections to all equipment installed as part of his contract.

C Electrical work shall be in accordance with all local, state and national codes and as specified in Division 26.

D Where architectural features and elements govern location of work, refer to Architectural drawings prior to fabrication of materials or system components.

E Refer to the Structural Drawings to become familiar with structural member sizes, framing type and configuration, opening sizes, and other details that could impact the work. Failure to coordinate with the Work of other trades, resulting in relocation of installed work to coordinate with architectural and/or structural elements, shall NOT be allowed as a basis for extra compensation by the contractor.

F Where piping, ductwork, or other items are indiacted to be routed in the webbing of joists or trusses, the mechanical contractor shall confirm with the General Contractor/Construction Manager and steel supplier the final joist/truss profile prior to fabricating or order materials. The actual final joist/truss profile shall be used in the BIM coordination effort.

G Openings for insulated piping shall be based on the outside diameter of the insulation with continuous insulation through the opening.

H Seal non-fire rated floor penetrations with non-shrink grout or urethane caulk, as appropriate.

I Seal non-rated wall openeings with urethane caulk.

J Duct/pipe/conduit penetrations through floor slabs of mechanical platforms or slabs above the bottom floor shall have water stopped curb surrounding the pipe/duct/conduit opening. Coordinate with Construction Manager/General Contractor to confirm openings based on Coordination Drawings.

K Pipe, conduit and duct chases required for installation of work shall be provided by the General Contractor unless otherwise noted. This Contractor shall be responsible for coordinating the location of all required chases.

L All work shall be coordinated with other trades. Cutting of new work and subsequent patching shall be at the Contractor's expense at no extra cost to the Owner.

M Contractor shall review the complete construction document package and determine, prior to the bid, which portions of the above grade structural slabs are hard rock concrete and/or light weight insulating concrete. Contractor shall review the Structural Engineer's requirements for attachment of loads to slabs, joists, trusses, and other structural members. DO NOT exceed point loads on Structural Engineer's drawings and

details. Unistrut and/or other support appartus required to span multiple joists or beams shall be included in the Contractor's bid. No additional monies will be given for support steel or other components required to support Mechanical piping, duct, equipment, or other items.

**1.08 GUARANTEE**

A See the General and Supplementary General Conditions

B Where extended warranties or guarantees are available from the manufacturer, the Contractor shall prepare the necessary contract documents to validate these warranties as required by the manufacturer and present them to the Architect/Engineer.

C The Contractor shall include in his bid a full warranty and guarantee for a five (5) year period on the compressors for the refrigeration equipment, including all chillers. This warranty does not include labor following the first year's Labor and Material Warranty.

**PART 2 PRODUCT**

**2.01 GENERAL REQUIREMENTS**

A Materials and equipment shall be new, unless noted otherwise, of the highest grade and quality and free from defects or other imperfections. Materials and equipment found defective shall be removed and replaced at the contractor's expense.

B The contractor shall provide name plates for identification of all equipment, switches, panels, etc.

C The name plates shall be laminated phenolic plastic, black front and back with white core, white engraved letters (1/4" minimum) etched into the white core. Name plates shall be fastened with sheet metal screws.

**PART 3 EXECUTION**

**3.01 INSPECTION**

A This Contractor shall examine the areas of completed work and shall insure that no defects or errors are present which would result in the poor application or installation of subsequent work.

**3.02 TEMPORARY SERVICES**

A Refer to Division 01

**3.03 INSTALLATION**

A All work shall be performed in a manner indicating proficiency in the trade.

B Contractor may install additional piping, fittings, valves, etc., not indicated on the drawings, for testing purposes or for convenience to faciliate installation of the work. Where such materials are installed, they shall comply with the specifications and shall be sizes to be compatible with system design. Remove such materials when they interfere with design conditions or as directed by the Engineer.

C Use of access panels in inaccessible ceilings for access to equipment, valves, dampers, etc., is not permitted, unless access panels are indicated on the Architectural reflected ceiling plans. Review any locations where additional access panels may be required with the Architect prior to incorporating into Work.

D This Contractor shall be responsible for completely cleaning the fireproofing from ALL materials or equipment installed as part of this Contract. This includes, but is not limited to, ductwork, piping, conduit, equipment, faceplates, boxes, disconnects, control panels, and cabling.

E All conduit, pipes, ducts, etc. shall be either parallel to building walls or plumb where installed in a vertical position and shall be concealed when located in architecturally finished areas.

F Any cutting or patching required for installation of this Contractor's work shall be kept to a minimum. Written approval shall be required by the Architect/Engineer if cutting of primary structure is involved.

G All patching shall be done in such a manner as to restore the areas or surfaces to match existing finishes.

H The Contractor shall lay out and install his work in advance of pouring concrete floors or walls. He shall furnish all sleeves to the General Contractor for openings through poured masonry floors or walls, above grade, required for passage of all conduits, pipes, or ducts installed by him. The Contractor shall provide all inserts and hangers required to support his equipment.

I The annular space around ALL wall and floor penetrations shall be properly sealed. For rated assemblies, a UL listed method shall be used. For non-rated wall and floors, the annular space shall be packed with mineral wool, or another suitable non-combustible material, and caulked air tight.

J Installation of piping and ductwork shall not interfere with walkways or service access.

K All trapeze hanger rods shall be cut to within 1" of the bottom nut.

L Provide minimum 1/2" thick closed cell elastomeric foam insulation, applied with adhesive, on lower edges of equipment and mechanical duct and pipe supporting elements suspended less than 7 ft above finished floors, platforms, or roofs.

**3.04 PERFORMANCE**

A The Contractor shall perform all excavation and backfill operations necessary for installation of his work.

**3.05 ERECTION**

A All support steel, angles, channels, pipes or structural steel stands and anchoring devices that may be required to rigidly support or anchor material and equipment shall be provided by this Contractor.

**3.06 FIELD QUALITY CONTROL**

A The Contractor shall conform to the requirements of Division 3 for concrete testing.

B All testing required for compliance with the Contract shall be as stated in subsequent sections.

**3.07 ADJUST AND CLEAN**

A All equipment and installed materials shall be thoroughly clean and free of all dirt, oil, grit, grease, etc.

B Clean piping and ductwork both internally and externally to remove dirt, dust, debris, and other foreign matter. When external surfaces of piping are rusted, clean and restore surface to original condition.

C Clean all equipment as recommended by the manufacturer.

D Factory painted equipment shall not be repainted unless damaged areas exist. These areas shall be touched up with a material suitable for intended service. In no event shall name plates be painted.

E Dirt, dust, and other foreign matter shall be blown and/or cleaned from coils, terminal devices, diffusers, registers, and grilles. Inspect all coils and comb coil fins where damaged to as-new condition prior to test and balance work.

F If the Owner has doubts or concerns about the cleanliness of the ductwork or air handling systems, the Owner reserves the right to have a third-party assessment performed by a board certified indoor environmental consultant to determine if the installation meets requirements as stipulated in the National Air Duct Cleaners Association (NADCA) Assessment, Cleaning, and Restoration of HVAC Systems. If duct systems or air handling units are found to have accumulated dirt or foreign matter on interior surfaces in violation of NADCA guidelines, the Contractor shall be responsible for all costs required to restore the air distribution system to new condition to the satisfaction of the Owner. This shall include payment for all costs associated with third party testing of the systems.

G At a scheduled meeting, the Contractor shall instruct the Owner or the Owner's representative in the operation and maintenance of all equipment installed under his Contract (in the presence of the Engineer).

H Equipment with filter media shall be run for a period of two (2) weeks after completion of work at which time a new filter media shall be installed with one change of filter media provided the Owner for future replacement. (Provide a total of three (3) sets).

I The Contractor shall adjust the tension on all belts six months after the final inspection.

**3.08 TESTING AND BALANCING**

A Tests for equipment, ductwork, piping, and other systems shall be performed as specified in their respective sections in accordance with technical requirements indicated.

B Provide equipment and devices required for testing, including fittings for additional openings as required for the test apparatus.

C All ductwork and piping inspections and testing shall be successfully completed with test reports reviewed and approved by the Engineer before concealment or application of covering materials.

D Testing shall be witnessed by the Engineer, unless otherwise indicated. Notify Engineer, Owner, Commission Authority, and other parties at least 72 hours in advance of testing date. Engineer, at his discretion, may opt not to witness a given test. In this case, The Construction Manager/General Contractor and/or CxA shall witness the test and forward results to Engineer for review.

E Contractor shall be responsible for certifying in writing all equipment and system test results. Certification shall include identification of portion of system tested, date, time, weather conditions, test criteria, testing medium, and pressure used, duration of test, and name and title of person signing test certification document. Results shall be submitted to Engineer within three (3) days of test completion.

**3.09 MAINTENANCE AND OPERATING MANUAL**

A The Contractor shall prepare a PDF version of the manual describing the proper maintenance and system operation. This manual shall not consist of standard factory printed data intended for dimension or design purposes (although these may be included), but shall be prepared to describe this particular job. This manual shall include the following:

1. A check list for periodic maintenance of all equipment.
2. Suggested setting of all controls and switches for normal operation, with description of control and its location.
3. A check list for seasonal shutdown.
4. Maintenance and spare parts data for each major piece of equipment.
5. As-built wiring, interlock and control diagrams for equipment with color coding shown on wiring and interlock diagrams.
6. Air and Water Balance Report.

B The PDF shall be indexed, bookmarked, dated and signed by the Contractor when completed.

C The operating and maintenance manuals shall be submitted to the Engineer for approval. When the manuals are considered complete by the Engineer, they will be turned over to the Owner for their permanent use.

D For each major piece of equipment, the Contractor shall organize and record on video the on-site training sessions. A copy of the video shall be turned over to the Owner at the completion of the project.

**END OF SECTION 23 01 00**

# SECTION 23 05 13
# COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A General construction and requirements.
B Applications.
C Single phase electric motors.
D Three phase electric motors.
E Electronically Commutated Motors (ECM).

### 1.02 RELATED REQUIREMENTS

A Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

### 1.03 REFERENCE STANDARDS

A ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015 (Reaffirmed 2020).
B IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2017.
C NEMA MG 1 - Motors and Generators; 2021.
D NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

### 1.04 SUBMITTALS

A See Section 01 30 00 - Administrative Requirements for submittal procedures.
B Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.
C Test Reports: Indicate test results verifying nominal efficiency and power factor for three phase motors larger than 1/2 horsepower.
D Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.
E Operation Data: Include instructions for safe operating procedures.
F Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

### 1.05 QUALITY ASSURANCE

A Manufacturer Qualifications: Company specializing in manufacture of electric motors for general use, and their accessories, with minimum three years documented product development, testing, and manufacturing experience.
B Comply with NFPA 70.
C Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

### 1.06 DELIVERY, STORAGE, AND HANDLING

A Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

### 1.07 WARRANTY

A See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

## PART 2 PRODUCTS

### 2.01 GENERAL CONSTRUCTION AND REQUIREMENTS

A Electrical Service: Refer to Section 26 05 83 for required electrical characteristics.
B Construction:
1. Open drip-proof type except where specifically noted otherwise.
2. Design for continuous operation in 104 degrees F environment.
3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

C Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.
D Wiring Terminations:
1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.

2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

**2.02 APPLICATIONS**

A Exception: Motors less than 250 watts, for intermittent service may be the equipment manufacturer's standard and need not comply with these specifications.

B Single phase motors for shaft mounted fans or blowers: Permanent split capacitor type.

C Motors located in exterior locations and air cooled condensers: Totally enclosed type.

**2.03 SINGLE PHASE POWER - SPLIT PHASE MOTORS**

A Starting Torque: Less than 150 percent of full load torque.

B Starting Current: Up to seven times full load current.

C Breakdown Torque: Approximately 200 percent of full load torque.

D Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.

E Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

**2.04 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS**

A Starting Torque: Exceeding one fourth of full load torque.

B Starting Current: Up to six times full load current.

C Multiple Speed: Through tapped windings.

D Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

**2.05 THREE PHASE POWER - SQUIRREL CAGE MOTORS**

A Starting Torque: Between 1 and 1-1/2 times full load torque.

B Starting Current: Six times full load current.

C Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D Design, Construction, Testing, and Performance: Comply with NEMA MG 1 for Design B motors.

**2.06 ELECTRONICALLY COMMUTATED MOTORS (ECM)**

A Applications:

1. Commercial:
   a. Roof Top Unit:
      1) Operating Mode: Constant speed.
      2) Input: Motor manufacturer to coordinate control requirements with the control board of the roof top unit and/or specified sequence of operation.
   b. Hydronic Blower Coil Unit:
      1) Operating Mode: Constant cfm.
      2) Input: Motor manufacturer to coordinate control requirements with the control board of the fan coil unit and/or specified sequence of operation.
   c. Package Terminal Air Conditioner (PTAC):
      1) Operating Mode: Constant speed.
      2) Input: Motor manufacturer to coordinate control requirements with the control board of the PTAC and/or specified sequence of operation.
   d. Power Roof Ventilator (PRV):
      1) Operating Mode: Constant cfm.
      2) Input: Motor manufacturer to coordinate control requirements with the control board of the PRV and/or specified sequence of operation.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A Install in accordance with manufacturer's instructions.

B Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C Check line voltage and phase and ensure agreement with nameplate.

**END OF SECTION 23 05 13**

# SECTION 23 05 17
# SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Pipe sleeves.

B Pipe-sleeve seals.

### 1.02 RELATED REQUIREMENTS

A Section 07 84 00 - Firestopping.

B Section 23 05 23 - General-Duty Valves for HVAC Piping.

C Section 23 05 53 - Identification for HVAC Piping and Equipment: Piping identification.

D Section 23 07 16 - HVAC Equipment Insulation.

E Section 23 07 19 - HVAC Piping Insulation.

### 1.03 REFERENCE STANDARDS

A ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2022a.

B ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).

C FM (AG) - FM Approval Guide; Current Edition.

D UL (DIR) - Online Certifications Directory; Current Edition.

### 1.04 SUBMITTALS

A See Section 01 30 00 - Administrative Requirements for submittal procedures.

B Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

C Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.

### 1.05 QUALITY ASSURANCE

A Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B Installer Qualifications: Company specializing in performing work of the type specified this section.

1. Minimum three years experience.
2. Approved by manufacturer.

C Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

### 1.06 DELIVERY, STORAGE, AND HANDLING

A Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

### 1.07 WARRANTY

A See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B Correct defective Work within a five year period after Date of Substantial Completion.

## PART 2 PRODUCTS

### 2.01 PIPE SLEEVES

A Manufacturers:

1. Flexicraft Industries; Pipe Wall Sleeve: www.flexicraft.com/#sle.

B Vertical Piping:

1. Sleeve Length: 1 inch above finished floor.
2. Provide sealant for watertight joint.

C Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

D Clearances:

1. Provide allowance for insulated piping.
2. Wall, Floor, Partitions, and Beam Flanges: 1 inch greater than external pipe diameter.

3. All Rated Openings: Caulked tight with fire stopping material in compliance with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.

**2.02 PIPE-SLEEVE SEALS**

A Manufacturers:
1. Advance Products & Systems, LLC; Innerlynx: www.apsonline.com/#sle.
2. American Polywater Corporation; PGKD Modular Seals: www.polywater-haufftechnik.com/#sle.
3. Flexicraft Industries; PipeSeal: www.flexicraft.com/#sle.

B Modular Mechanical Sleeve-Seal:
1. Elastomer-based interlocking links continuously fill annular space between pipe and wall-sleeve, wall or casing opening.
2. Watertight seal between pipe and wall-sleeve, wall or casing opening.
3. Size and select seal component materials in accordance with service requirements.
4. Glass-reinforced plastic pressure end plates.

C Sealing Compounds:
1. Provide packing and sealing compound to fill pipe to sleeve thickness.
2. Combined packing and seal compound is to match partition fire-resistance hourly rating.

D Wall Sleeve: Steel material with waterstop collar, and nailer end-caps.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B Install piping to conserve building space, to not interfere with use of space and other work.

C Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
1. Aboveground Piping:
   a. Pack solid using mineral fiber in compliance with ASTM C592.
   b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.

E Manufactured Sleeve-Seal Systems:
1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a water-tight seal.
6. Install in accordance with manufacturer's recommendations.

F When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

**END OF SECTION 23 05 17**

# SECTION 23 05 19
# METERS AND GAUGES FOR HVAC PIPING

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Pressure gauges and pressure gauge taps.

B Thermometers and thermometer wells.

### 1.02 RELATED REQUIREMENTS

A Section 23 21 13 - Hydronic Piping.

### 1.03 REFERENCE STANDARDS

A ASME B40.100 - Pressure Gauges and Gauge Attachments; 2022.

B ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014 (Reapproved 2020).

C ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014 (Reapproved 2021).

D UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

### 1.04 SUBMITTALS

A See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

## PART 2 PRODUCTS

### 2.01 PRESSURE GAUGES

A Manufacturers:

1. Dwyer Instruments, Inc; _____: www.dwyer-inst.com/#sle.
2. Moeller Instrument Company, Inc; _____: www.moellerinstrument.com/#sle.
3. Omega Engineering, Inc; _____: www.omega.com/#sle.

B Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.

1. Case: Steel with brass bourdon tube.
2. Size: 4-1/2 inch diameter.
3. Mid-Scale Accuracy: One percent.

### 2.02 PRESSURE GAUGE TAPPINGS

A Gauge Cock: Tee or lever handle, brass for maximum 150 psi.

B Needle Valve: Brass, 1/4 inch NPT for minimum 150 psi.

### 2.03 STEM TYPE THERMOMETERS

A Manufacturers:

1. Dwyer Instruments, Inc; _____: www.dwyer-inst.com/#sle.
2. Omega Engineering, Inc; _____: www.omega.com/#sle.
3. Weksler Glass Thermometer Corp; _____: www.wekslerglass.com/#sle.

B Thermometers - Fixed Mounting: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish.

1. Size: 9 inch scale.
2. Window: Clear Lexan.
3. Stem: ____ inch brass.
4. Accuracy: 2 percent, per ASTM E77.
5. Calibration: Degrees F.

### 2.04 THERMOMETER SUPPORTS

A Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

## PART 3 EXECUTION

### 3.01 INSTALLATION

A Install in accordance with manufacturer's instructions.

B Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

C Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

**END OF SECTION 23 05 19**

# SECTION 23 05 23
# GENERAL-DUTY VALVES FOR HVAC PIPING

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Applications.
B Ball valves.
C Butterfly valves.
D Check valves.
E Chainwheels.

### 1.02 ABBREVIATIONS AND ACRONYMS

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 PTFE: Polytetrafluoroethylene.
G RS: Rising stem.
H SWP: Steam working pressure.
I TFE: Tetrafluoroethylene.
J WOG: Water, oil, and gas.

### 1.03 REFERENCE STANDARDS

A ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).
B ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.
C ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.
D ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
E ASME B31.9 - Building Services Piping; 2020.
F ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.
G ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).
H ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).
I ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).
J AWWA C606 - Grooved and Shouldered Joints; 2022.
K MSS SP-67 - Butterfly Valves; 2022.
L MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends; 2018.
M MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .
N MSS SP-125 - Check Valves: Gray Iron and Ductile Iron, In-Line, Spring-Loaded, Center-Guided; 2018.

### 1.04 SUBMITTALS

A Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
B Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
C Maintenance Materials: Furnish Owner with one size of each type of valve on the project.

### 1.05 QUALITY ASSURANCE

A Manufacturer:
1. Obtain valves for each valve type from single manufacturer.
2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

B Welding Materials and Procedures: Comply with ASME BPVC-IX.

**1.06 DELIVERY, STORAGE, AND HANDLING**

A Prepare valves for shipping as follows:
1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
2. Protect valve parts exposed to piped medium against rust and corrosion.
3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
4. Secure check valves in either the closed position or open position.
5. Adjust butterfly valves to closed or partially closed position.

B Use the following precautions during storage:
1. Maintain valve end protection and protect flanges and specialties from dirt.
   a. Provide temporary inlet and outlet caps.
   b. Maintain caps in place until installation.
2. Store valves in shipping containers and maintain in place until installation.
   a. Store valves indoors in dry environment.
   b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

C Exercise the following precautions for handling:
1. Handle large valves with sling, modified to avoid damage to exposed parts.
2. Avoid the use of operating handles or stems as rigging or lifting points.

**PART 2 PRODUCTS**

**2.01 APPLICATIONS**

A Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).

B Provide the following valves for the applications if not indicated on drawings:
1. Isolation (Shutoff): Butterfly and Ball.
2. Swing Check (Pump Outlet):
   a. Size 2 inch and Smaller: Bronze with bronze disc.
   b. 2-1/2 NPS and Larger: Iron with center guided with stainless steel seat.
3. Dead-End: Butterfly, single-flange (lug) type.

C Substitutions of valves with higher CWP classes or WSP ratings for same valve types are permitted when specified CWP ratings or WSP classes are not available.

D Required Valve End Connections for Non-Wafer Types:
1. Steel Pipe:
   a. Size 2 inch and Smaller: Threaded ends.
   b. Size 2-1/2 inch and Larger: Welded.
2. Copper Tube:
   a. 2 NPS and Smaller: Solder-joint valve-ends.

E Heating Hot Water Valves:
1. 2 NPS and Smaller, Bronze Valves:
   a. Threaded ends for steel pipe.
   b. Soldered ends for copper pipe.
   c. Ball: Full port, two piece, stainless steel trim.
   d. Swing Check: Bronze disc, Class 125.
2. 2-1/2 NPS and Larger, Iron Valves:
   a. Single-Flange Butterfly: 2-1/2 NPS to 12 NPS, aluminum-bronze disc, EPDM seat, 200 CWP.
   b. Center-Guided Check: Compact-wafer, resilient seat, Class 125.

**2.02 MANUFACTURERS**

A Provide all valves of each type from a single manufacturer.

B Manufacturers:
1. Anvil
2. Apollo
3. Hammond
4. ITT Grinnell
5. Milwaukee
6. Nibco

7. Victaulic
8. Or Approved Equal

**2.03 GENERAL REQUIREMENTS**

A Valve Pressure and Temperature Ratings: No less than rating indicated.

B Valve Sizes: Match upstream piping unless otherwise indicated.

C Valve Actuator Types:
1. Gear Actuator: Quarter-turn valves 8 NPS and larger.
2. Handwheel: Valves other than quarter-turn types.
3. Hand Lever: Quarter-turn valves 6 NPS and smaller.
4. 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.

D Valves in Insulated Piping: Provide 2-1/4" stem extensions and the following features:
1. Hot Water Ball Valves: Metal stem extension is acceptable.
2. Butterfly Valves: Extended neck.

E Valve-End Connections:
1. Threaded End Valves: ASME B1.20.1.
2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
3. Pipe Flanges and Flanged Fittings 1/2 NPS through 24 NPS: ASME B16.5.
4. Solder Joint Connections: ASME B16.18.
5. Grooved End Connections: AWWA C606.

F General ASME Compliance:
1. Building Services Piping Valves: ASME B31.9.

G Bronze Valves:
1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

H Source Limitations: Obtain each valve type from a single manufacturer.

**2.04 BRONZE, BALL VALVES**

A General:
1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

B Two Piece, Full Port with Stainless Steel Trim:
1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
4. Body: Bronze
5. Stem: 316 Stainless steel.
6. Ball: Stainless steel vented.
7. Handle: Provide lever handle with 2-1/4" stem extension for insulation. On chilled water valves or other fluids below ambient temperature, use non-conductive handle extensions.

**2.05 IRON, SINGLE FLANGE BUTTERFLY VALVES**

A Lug type: Bi-directional dead end service without downstream flange.
1. Comply with MSS SP-67, Type I.
2. CWP Rating: 150 psig and 200 psig.
3. Body Material: ASTM A536 ductile iron.
4. Seat: EPDM or Viton.
5. Disc: Aluminum-bronze or stainless steel.

**2.06 IRON, CENTER-GUIDED CHECK VALVES**

A Class 150, Compact-Wafer:
1. Comply with MSS SP-125.
2. 2-1/2 NPS to 12 NPS, CWP Rating: 300 psig.
3. Body Material: ASTM A395/A395M or ASTM A536, ductile iron or cast iron.
4. Resilient Seat: EPDM, NBR, or stainless steel.

**2.07 CHAINWHEELS**

A Description: Valve actuation assembly with sprocket rim, brackets, and chain.
1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
2. Attachment: For connection to butterfly valve stems.
3. Sprocket Rim with Chain Guides: Ductile iron include zinc coating.
4. Chain: Hot-dip galvanized steel. Sized to fit sprocket rim.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A Discard all packing materials and verify that valve interior, including threads and flanges, are completely clean without signs of damage or degradation that could result in leakage.

B Verify valve parts to be fully operational in all positions from closed to fully open.

C Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.

D Should valve be determined to be defective, replace with new valve.

**3.02 INSTALLATION**

A Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

B All valves shall be installed within 24" of the lay-in ceiling.

C DO NOT install valves above cable tray.

D Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

E Where valve support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welds.

F Install check valves where necessary to maintain direction of flow as follows:
1. Swing Check: Install horizontal maintaining hinge pin level.
2. Orient center-guided into horizontal or vertical position, between flanges.

G Provide chainwheels on operators for valves 8" and larger where located 96" or more above finished floor, terminating 60" above finished floor.

**END OF SECTION 23 05 23**

# SECTION 23 05 29
# HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Support and attachment components.

### 1.02 RELATED REQUIREMENTS

A Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

B Section 05 50 00 - Metal Fabrications: Materials and requirements for fabricated metal supports.

### 1.03 REFERENCE STANDARDS

A ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2023.

D ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

E ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

F ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

G ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).

H ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

I ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023c.

J ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).

K FM (AG) - FM Approval Guide; Current Edition.

L MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

M UL (DIR) - Online Certifications Directory; Current Edition.

N UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

## PART 2 PRODUCTS

### 2.01 SUPPORT AND ATTACHMENT COMPONENTS

A General Requirements:

1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
4. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
   a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
   b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B Prefabricated Trapeze-Framed Metal Strut Systems:

1. Strut Channel or Bracket Material:
   a. Indoor Dry Locations: Use zinc-plated steel or galvanized steel.
   b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
2. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
3. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.
4. Accessories: Provide bracket covers, cable basket clips, cable tray clips, clamps, conduit clamps, fire-retarding brackets, j-hooks, protectors, and vibration dampeners.

C Hanger Rods:
1. Threaded zinc-plated steel unless otherwise indicated.
2. Minimum Size, Unless Otherwise Indicated or Required:
   a. Equipment Supports: 1/2 inch diameter.
   b. Piping up to 1 inch: 1/4 inch diameter.
   c. Piping larger than 1 inch: 3/8 inch diameter.
   d. Trapeze Support for Multiple Pipes: 3/8 inch diameter.

D Thermal Insulated Pipe Supports:
1. General Requirements:
   a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
   b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
   c. Pipe supports to be provided for nominally sized, 1/2 to 30 inch iron pipes.
   d. Insulation inserts to consist of calcium silicate insulation surrounded by a 360 degree, PVC jacketing.
2. PVC Jacket:
   a. Pipe insulation protection shields to be provided with a ball bearing hinge and locking seam.
   b. Minimum Service Temperature: Minus 40 degrees F.
   c. Maximum Service Temperature: 180 degrees F.
   d. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
   e. Thickness: 60 mil.

E Beam Clamps:
1. MSS SP-58 types 19 through 23, 25 or 27 through 30 based on required load.
2. Beam C-Clamp: MSS SP-58 type 23, malleable iron and steel with zinc finish.
3. Small or Junior Beam Clamp: MSS SP-58 type 19, malleable iron with zinc finish. For inverted usage provide manufacturer listed size(s).
4. Wide Mouth Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish.
5. Centerload Beam Clamp with Extension Piece: MSS SP-58 type 30, malleable iron with plain finish.
6. FM (AG) and UL (DIR) Approved Beam Clamp: MSS SP-58 type 19, plated finish,
7. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
8. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

F Riser Clamps:
1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
2. MSS SP-58 type 1 or 8, steel with stainless steel or zinc plated finish.
3. Medium Split Horizontal Pipe Clamp: MSS SP-58 type 4, carbon steel with stainless steel or zinc plated finish.
4. Copper Tube Pipe Clamp: MSS SP-58 type 8, epoxy plated copper.
5. UL (DIR) listed: Pipe sizes 1/2 to 8 inch.

G Pipe Hangers:
1. Split Ring Hangers:
   a. Provide hinged split ring and yoke roller hanger with zinc finish.
   b. Material: ASTM A47/A47M malleable iron or ASTM A36/A36M carbon steel.
   c. Provide hanger rod and nuts of the same type and material for a given pipe run.
   d. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

H Pipe Shields for Insulated Piping:
1. General Construction and Requirements:
   a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
   b. Shields Material: UV-resistant polypropylene with glass fill.
   c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.

d. Minimum Service Temperature: Minus 40 degrees F.
e. Maximum Service Temperature: 178 degrees F.
f. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

I Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A Install products in accordance with manufacturer's instructions.
B Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
C Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
D Unless specifically indicated or approved by Architect, do not provide support from roof deck.
E Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
F Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.
G Equipment Support and Attachment:
1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 6 high concrete pad constructed in accordance with Section 03 30 00.
5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
H Secure fasteners according to manufacturer's recommended torque settings.
I Remove temporary supports.

**END OF SECTION 23 05 29**

**SECTION 23 05 48**
**VIBRATION AND SEISMIC CONTROLS FOR HVAC**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Vibration isolation requirements.
B Vibration-isolated equipment support bases.
C Vibration-isolated and/or seismically engineered roof curbs.

### 1.02 REFERENCE STANDARDS

A ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.

### 1.03 SUBMITTALS

A See Section 01 30 00 - Administrative Requirements for submittal procedures.
B Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.

## PART 2 PRODUCTS

### 2.01 VIBRATION ISOLATION REQUIREMENTS

A Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing HVAC equipment and/or HVAC connections to vibration-isolated equipment.
B Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:
C General Requirements:
1. Select vibration isolators to provide required static deflection.
2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
D Equipment Isolation: RTU's and BCU's.

### 2.02 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

A Manufacturers:
1. Vibration-Isolated Equipment Support Bases:
a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
b. Mason Industries: www.mason-ind.com/#sle.
c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
d. Vibro-Acoustics: www.vibro-acoustics.com/#sle.
2. Source Limitations: Furnish vibration-isolated equipment support bases and associated components and accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.

### 2.03 VIBRATION-ISOLATED AND/OR SEISMICALLY ENGINEERED ROOF CURBS

A Manufacturers:
1. Vibration-Isolated and/or Seismically Engineered Roof Curbs:
a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
b. Mason Industries: www.mason-ind.com/#sle.
c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
d. Vibro-Acoustics: www.vibro-acoustics.com/#sle.
B Vibration Isolation Curbs:
1. Nonseismic Curb:
a. Location: Between structure and rooftop equipment.
b. Construction: Aluminum.
c. Integral vibration isolation to comply with requirements of this section.
d. Weather exposed components consist of corrosion resistant materials.
e. Provide calculations and anchoring details for high wind zone listed on drawings.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A Verify that field measurements are as shown on the drawings.

B Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 INSTALLATION

A Install products in accordance with manufacturer's instructions.

B Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C Secure fasteners according to manufacturer's recommended torque settings.

D Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

E Vibration Isolation Systems:

1. Vibration-Isolated Equipment Support Bases:
    a. Provide specified minimum clearance beneath base.
2. Spring Isolators:
    a. Position equipment at operating height; provide temporary blocking as required.
    b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
    c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
3. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
4. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
5. Adjust isolators to be free of isolation short circuits during normal operation.
6. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

**END OF SECTION 23 05 48**

# SECTION 23 05 53
# IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Nameplates.
B Tags.
C Stencils.
D Pipe markers.
E Ceiling tacks.

### 1.02 RELATED REQUIREMENTS

A Section 09 91 23 - Interior Painting: Identification painting.

### 1.03 REFERENCE STANDARDS

A ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.
B ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

### 1.04 SUBMITTALS

A See Section 01 30 00 - Administrative Requirements for submittal procedures.
B List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
C Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
D Product Data: Provide manufacturers catalog literature for each product required.

## PART 2 PRODUCTS

### 2.01 IDENTIFICATION APPLICATIONS

A Air Handling Units: Nameplates.
B Automatic Controls: Tags. Key to control schematic.
C Control Panels: Nameplates.
D Dampers: Ceiling tacks, where located above lay-in ceiling.
E Major Control Components: Nameplates.
F Piping: Tags.
G Small-sized Equipment: Tags.
H Valves: Tags and ceiling tacks where located above lay-in ceiling.

### 2.02 NAMEPLATES

A Letter Color: White.
B Letter Height: 1/4 inch.
C Background Color: Black.
D Plastic: Comply with ASTM D709.

### 2.03 TAGS

A Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

### 2.04 STENCILS

A Stencils: With clean cut symbols and letters of following size:
1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.

### 2.05 CEILING TACKS

A Description: Steel with 3/4 inch diameter color coded head.
B Color code as follows:
1. HVAC Equipment: Yellow.
2. Fire Dampers and Smoke Dampers: Red.
3. Heating/Cooling Valves: Blue.

## PART 3 EXECUTION

### 3.01 PREPARATION

A Degrease and clean surfaces to receive adhesive for identification materials.
B Prepare surfaces in accordance with Section 09 91 23 for stencil painting.

**3.02 INSTALLATION**

A Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B Install tags with corrosion resistant chain.

C Apply stencil painting in accordance with Section 09 91 23.

D Install plastic pipe markers in accordance with manufacturer's instructions.

E Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

F Use tags on piping 3/4 inch diameter and smaller.

1. Identify service, flow direction, and pressure.
2. Install in clear view and align with axis of piping.
3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

**END OF SECTION 23 05 53**

# SECTION 23 05 70
# MECHANICAL COORDINATION DRAWINGS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A The Mechanical Contractor shall be responsible for providing 1/4" scale coordination drawings for the entire project, format shall be as stated below.

B The drawings shall cover above ceiling space, mechanical rooms, electrical rooms and service yards.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.01 COORDINATION

A The Mechanical Contractor shall obtain the architectural, structural, and MEP REVIT models from the Architect. The models will be in REVIT 2022.

B Where ductwork, piping, or other materials are indicated or required to be installed in the webbing of joists or trusses, the Mechanical Contractor shall confirm the actual joist/truss profile with the Structural Steel supplier prior to finalizing the coordination drawings or fabricating materials.

C The Mechanical Contractor shall produce drawings that indicate all piping, equipment and ductwork on ¼ scale drawings. All items shall be drawn to scale, dimensioned and be easily identified. The drawings shall indicate a bottom of duct or bottom of pipe.

D The Mechanical Contractor shall import a file compatible with Navisworks from the Plumbing Contractor that indicates all piping and plumbing equipment. This includes underground piping. The drawings shall be to scale, dimensioned and clearly identified. The drawings shall indicate bottom of pipe (or centerline) for all equipment or pipes.

E The Mechanical Contractor shall import a file compatible with Navisworks from the Fire Protection Contractor that indicates all piping, heads, and equipment. The drawings shall be to scale, dimensioned and clearly identified. The drawings shall indicate bottom of pipe (or centerline) for all equipment or pipes.

F The Mechanical Contractor shall import a file compatible with Navisworks from the Electrical Contractor that indicate all conduits over 2”, lights, cable tray, underground duct banks and electrical equipment. The drawings shall be to scale, dimensioned and clearly identified. The drawings shall indicate mounting heights of all equipment.

G The Mechanical Contractor shall incorporate the Plumbing Contractor’s, Fire Protection Contractor's, and the Electrical Contractor’s models with his own model to make one overall set of Coordination Drawings for each area. The Mechanical Contractor shall adjust layers, colors, etc., to make the drawing readable.

H Navisworks shall be used for clash detection. The Mechanical Contractor shall review the overall coordination model for conflicts. If a conflict is found, the Mechanical Contractor shall coordinate revisions to the plans with each sub contractor. There shall be as many iterations as required to produce a clash-free model

I If any problems cannot be worked out between the Contractors, the Mechanical Contractor shall contact the Engineer. At that time, a meeting with the Engineer and the Architect will be arranged. The Mechanical Contractor shall make the overall coordination model available for the meeting.

J Once all conflicts have been resolved, the Mechanical Contractor shall provide the Architect and Engineer with a complete set of Coordination Drawings.

K In addition, the Mechanical Contractor shall send the completed overall coordination drawings to a printer so that the Plumbing, Fire Protection, and Electrical Contractors can order as many copies as they desire (at their expense). The Mechanical Contractor is responsible for providing the Engineer’s set, the Architect’s set, and the Mechanical Contractor ’s set(s).

L The Mechanical Contractor and the Construction Manager are responsible for setting the schedule for this process. The Plumbing Contractor, Fire Protection Contractor, Electrical Contractor and the Architect should approve the schedule.

M The Coordination Drawings shall be used as the basis for the As-built Drawings. These shall be made available to the Design Team for this purpose.

N The overall coordination drawings shall be completed prior to any plumbing, mechanical and electrical work beginning. Start of work, including underground work, without completed Coordination Drawings is at the

Contractor's risk.

**END OF SECTION 23 05 70 23 05 70**

# SECTION 23 05 93
# TESTING, ADJUSTING, AND BALANCING FOR HVAC

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Testing, adjustment, and balancing of air systems.

B Testing, adjustment, and balancing of hydronic and refrigerating systems.

C Measurement of final operating condition of HVAC systems.

D Commissioning activities.

### 1.02 RELATED REQUIREMENTS

A Section 01 91 13 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

B Section 23 08 00 - Commissioning of HVAC.

### 1.03 REFERENCE STANDARDS

A AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008, with Errata (2019).

### 1.04 SUBMITTALS

A Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

B TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.

1. Submit to Architect.
2. Submit to the Commissioning Authority.
3. Include at least the following in the plan:
    a. 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.
    b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
    c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
    d. Final test report forms to be used.
    e. Detailed step-by-step procedures for TAB work for each system and issue, including:
        1) Terminal flow calibration (for each terminal type).
        2) Diffuser proportioning.
        3) Branch/submain proportioning.
        4) Total flow calculations.
        5) Rechecking.
        6) Diversity issues.
    f. Expected problems and solutions, etc.
    g. Criteria for using air flow straighteners or relocating flow stations and sensors; analogous explanations for the water side.
    h. Details of how TOTAL flow will be determined; for example:
        1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
        2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.
    i. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.
    j. Confirmation of understanding of the outside air ventilation criteria under all conditions.
    k. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
    l. Methods for making coil or other system plant capacity measurements, if specified.
    m. Time schedule for deferred or seasonal TAB work, if specified.

n. False loading of systems to complete TAB work, if specified.
o. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
p. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
q. Procedures for formal deficiency reports, including scope, frequency and distribution.

C Field Logs: Submit at least twice a week to the Commissioning Authority.

D Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

E Progress Reports.

F Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

1. Submit to the the Commissioning Authority within two weeks after completion of testing, adjusting, and balancing.
2. Revise TAB plan to reflect actual procedures and submit as part of final report.
3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
6. Units of Measure: Report data in I-P (inch-pound) units only.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.01 GENERAL REQUIREMENTS

A Perform total system balance in accordance with one of the following:

1. AABC (NSTSB), AABC National Standards for Total System Balance.

B Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D TAB Agency Qualifications:

1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
2. Having minimum of three years documented experience.
3. Certified by one of the following:
   a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
   b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.

E TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

### 3.02 EXAMINATION

A Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.

11. Duct system leakage is minimized.
12. Proper strainer baskets are clean and in place.
13. Service and balance valves are open.

B Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C Beginning of work means acceptance of existing conditions.

**3.03 PREPARATION**

A Hold a pre-balancing meeting at least one week prior to starting TAB work.
1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.

C Provide additional balancing devices as required.

**3.04 ADJUSTMENT TOLERANCES**

A Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C Hydronic Systems: Adjust to within plus or minus 10 percent of design.

**3.05 RECORDING AND ADJUSTING**

A Field Logs: Maintain written logs including:
1. Running log of events and issues.
2. Discrepancies, deficient or uncompleted work by others.
3. Contract interpretation requests.
4. Lists of completed tests.

B Ensure recorded data represents actual measured or observed conditions.

C Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

**3.06 AIR SYSTEM PROCEDURE**

A Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C Measure air quantities at air inlets and outlets.

D Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

**3.07 WATER SYSTEM PROCEDURE**

A Adjust water systems to provide required or design quantities.

B Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gages to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature

difference across various heat transfer elements in the system.

C Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D Effect system balance with automatic control valves fully open to heat transfer elements.

E Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

**3.08 COMMISSIONING**

A See Sections 01 91 13 - General Commissioning Requirements and 23 08 00 for additional requirements.

B Perform prerequisites prior to starting commissioning activities.

C Fill out Prefunctional Checklists for:

1. Air side systems.
2. Water side systems.

D Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.

E Re-check a random sample equivalent to 25 percent of the final TAB report data as directed by Commissioning Authority.

1. Original TAB agency shall execute the re-checks, witnessed by the Commissioning Authority.
2. Use the same test instruments as used in the original TAB work.
3. Failure of more than 10 percent of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.
4. For purposes of re-check, failure is defined as follows:
   a. Air Flow of Supply and Return: Deviation of more than 10 percent of instrument reading.
   b. Minimum Outside Air Flow: Deviation of more than 20 percent of instrument reading; for inlet vane or VFD OSA compensation system using linear proportional control, deviation of more than 30 percent at intermediate supply flow.
   c. Temperatures: Deviation of more than one degree F.
   d. Air and Water Pressures: Deviation of more than 10 percent of full scale of test instrument reading.
   e. Sound Pressures: Deviation of more than 3 decibels, with consideration for variations in background noise.
5. For purposes of re-check, a whole system is defined as one in which inaccuracies will have little or no impact on connected systems; for example, the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system.

F In the presence of the Commissioning Authority, verify that:

1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.
2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.
3. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.

**3.09 SCOPE**

A Test, adjust, and balance the following:

1. Packaged Roof Top Heating/Cooling Units.
2. Packaged Terminal Air Conditioning Units.

3. Unit Air Conditioners.
4. Air Handling Units.
5. Fans.
6. Air Inlets and Outlets.

**3.10 MINIMUM DATA TO BE REPORTED**

A Electric Motors:
1. Manufacturer.
2. Model/Frame.
3. HP/BHP.
4. Phase, voltage, amperage; nameplate, actual, no load.
5. RPM.
6. Service factor.
7. Starter size, rating, heater elements.
8. Sheave Make/Size/Bore.

B V-Belt Drives:
1. Identification/location.
2. Required driven RPM.
3. Driven sheave, diameter and RPM.
4. Belt, size and quantity.
5. Motor sheave diameter and RPM.

C Air Cooled Condensers:
1. Identification/number.
2. Location.
3. Manufacturer.
4. Model number.
5. Serial number.
6. Entering DB air temperature, design and actual.
7. Leaving DB air temperature, design and actual.
8. Number of compressors.

D Cooling Coils:
1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Entering air DB temperature, design and actual.
7. Entering air WB temperature, design and actual.
8. Leaving air DB temperature, design and actual.
9. Leaving air WB temperature, design and actual.
10. Entering water temperature, design and actual.
11. Leaving water temperature, design and actual.
12. Saturated suction temperature, design and actual.
13. Air pressure drop, design and actual.

E Heating Coils:
1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Water flow, design and actual.
7. Water pressure drop, design and actual.
8. Entering water temperature, design and actual.

9. Leaving water temperature, design and actual.
10. Entering air temperature, design and actual.
11. Leaving air temperature, design and actual.
12. Air pressure drop, design and actual.

F Air Moving Equipment:

1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Arrangement/Class/Discharge.
6. Air flow, specified and actual.
7. Return air flow, specified and actual.
8. Outside air flow, specified and actual.
9. Total static pressure (total external), specified and actual.
10. Inlet pressure.
11. Discharge pressure.
12. Sheave Make/Size/Bore.
13. Number of Belts/Make/Size.
14. Fan RPM.

G Return Air/Outside Air:

1. Identification/location.
2. Design air flow.
3. Actual air flow.
4. Design return air flow.
5. Actual return air flow.
6. Design outside air flow.
7. Actual outside air flow.
8. Return air temperature.
9. Outside air temperature.
10. Required mixed air temperature.
11. Actual mixed air temperature.

H Exhaust Fans:

1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Air flow, specified and actual.
6. Total static pressure (total external), specified and actual.
7. Inlet pressure.
8. Discharge pressure.
9. Sheave Make/Size/Bore.
10. Number of Belts/Make/Size.
11. Fan RPM.

I Duct Traverses:

1. System zone/branch.
2. Duct size.
3. Area.
4. Design velocity.
5. Design air flow.
6. Test velocity.
7. Test air flow.
8. Duct static pressure.

9. Air temperature.
10. Air correction factor.

J Duct Leak Tests:
1. Description of ductwork under test.
2. Duct design operating pressure.
3. Duct design test static pressure.
4. Duct capacity, air flow.
5. Maximum allowable leakage duct capacity times leak factor.
6. Test apparatus:
   a. Blower.
   b. Orifice, tube size.
   c. Orifice size.
   d. Calibrated.
7. Test static pressure.
8. Test orifice differential pressure.
9. Leakage.

K Flow Measuring Stations:
1. Identification/number.
2. Location.
3. Size.
4. Manufacturer.
5. Model number.
6. Serial number.
7. Design Flow rate.
8. Design pressure drop.
9. Actual/final pressure drop.
10. Actual/final flow rate.
11. Station calibrated setting.

L Air Distribution Tests:
1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Area factor.
6. Design velocity.
7. Design air flow.
8. Test (final) velocity.
9. Test (final) air flow.
10. Percent of design air flow.

**END OF SECTION 23 05 93**

# SECTION 23 07 13
# DUCT INSULATION

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Duct insulation.
B Duct liner.
C Jacketing and accessories.

### 1.02 REFERENCE STANDARDS

A ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
B ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.
C ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.
D ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).
E ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).
F ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2020.
G ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2019.
H ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023c.
I ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).
J ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).
K UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

### 1.03 SUBMITTALS

A Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations. Include the following information:
   1. Schedule indicating insulation type, thickness, and location for each service
   2. Density
   3. Compressive Strength
   4. "k" value at 75 deg F
   5. Nominal "R" value
   6. Flame spread rating
B Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

### 1.04 QUALITY ASSURANCE

A Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.
B Applicator Qualifications: Company specializing in performing the type of work specified in this section, documented experience and approved by manufacturer.
C Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Owner. Use materials indicated for the completed Work. Mockups shall include piping insulation, ductwork insulation and equipment insulation.
D All the ductwork and piping in pump rooms, mechanical rooms and equipment rooms including areas without ceilings is to be considered as exposed piping or ductwork. This also includes penthouses, interstitial spaces, and crawl spaces, where applicable.

**1.05 DELIVERY, STORAGE, AND HANDLING**

A Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

**1.06 FIELD CONDITIONS**

A Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B Maintain temperature during and after installation for minimum period of 24 hours.

C Insulation shall not be installed until all testing and inspection of pipe, duct, vessel, etc. has been completed and approved by Engineer/Owner’s representative.

**PART 2 PRODUCTS**

**2.01 REGULATORY REQUIREMENTS**

A Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723. These ratings must be as tested on composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics, and cements must meet the same individual ratings as minimum requirements.

**2.02 GLASS FIBER, FLEXIBLE**

A Manufacturer:
1. CertainTeed Corporation
2. Johns Manville
3. Knauf Insulation
4. Owens Corning Corporation
5. Or Approved Equal

B Insulation: ASTM C553; flexible, noncombustible blanket.
1. K value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
2. Maximum Service Temperature: 1,200 degrees F.
3. Maximum Water Vapor Absorption: 5.0 percent by weight.

C Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with pressure-sensitive tape.

D Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

E Indoor Vapor Barrier Mastic:
1. Manufacturers:
   a. Childers CP-35
   b. Hardcast Seal-Tack AF

F Tie Wire: Annealed steel, 16 gauge, 0.0508 inch diameter.

**2.03 GLASS FIBER, RIGID**

A Manufacturer:
1. CertainTeed Corporation
2. Johns Manville
3. Knauf Insulation
4. Owens Corning Corporation
5. Or Approved Equal

B Insulation: ASTM C612; rigid, noncombustible blanket.
1. K Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
2. Maximum Service Temperature: 450 degrees F.
3. Maximum Water Vapor Absorption: 5.0 percent.
4. Maximum Density: 8.0 pcf.

C Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with pressure-sensitive tape.

D Vapor Barrier Tape:
1. Manufacturers:
   a. 3M
   b. Polyguard
   c. Shurtape
2. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

E Protective Coating:
1. Manufacturers:
   a. Design Polymerics; DP 2510 Water Based, Low VOC, Duct Liner Protective Coating:

F Indoor Vapor Barrier Finish:
1. Cloth: Untreated; 9 oz/sq yd weight, glass fabric.
2. Vinyl emulsion type acrylic, compatible with insulation, white color.

## 2.04 POLYISOCYANURATE INSULATION BOARD

A Manufacturer:
1. Dyplast
2. Rmax
3. Johns Manville
4. Or Approved Equal

B Insulation:
1. Flat Foam Insulation with Heavy Duty Fiber-Reinforced Facers: closed-cell polyisocyanurate foam core laminated to extra durable heavy duty fiber-reinforced facers on both sides; conforming to ASTM C 1289, Type II, Class 2.
2. Blowing Agent: Zero ODP, 3rd generation.
3. Thickness 2.00 inch, R Value 11.4, flute spanability 4-3/8 inches
4. 25/450 flame/smoke spread rating

C Vapor Barrier Jacket:
1. Asphalt Bitumen: ASTM D 312, Type III, or Type IV.

D Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

## 2.05 JACKETING AND ACCESSORIES

A Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire-retardant lagging adhesive.
1. Lagging Adhesive:
   a. Manufacturers:
      1) Design Polymerics; DP 3050 Water Based, Zero VOC, Premium Quality, Lagging Adhesive, and Vapor Retarder
      2) Childers CP-35
   b. Compatible with insulation.

B Mineral Fiber (Outdoor) Jacket: Asphalt impregnated and coated sheet, 50 lb/square.

C Aluminum Jacket:
1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
2. Thickness: 0.016 inch sheet.
3. Finish: Embossed.
4. Joining: Longitudinal slip joints and 2 inch laps.
5. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.

6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

**2.06 FIRE BARRIER DUCT WRAP**

A Two-layer wrap for grease ducts rated as a shaft alternative per ASTM E 2336.Zero clearance to combustible throughout the entire enclosure system.

B High-temperature fibrous thermal insulation blanket encapsulated in a fiberglass-reinforced aluminized polyester foil. Duct Wrap density shall be nominal 6 pcf and have a nominal 1-1/2" thickness. The fiber blanket shall have a continuous use limit of 1000°C.

C When installed in two layers, shall meet the criteria of ASTM E 2336 Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems.

D Smoke Developed Index and Flame Spread Index of the bare blanket, and of the foil encapsulated blanket shall be 0/0 per ASTM E 84. The foil encapsulation shall be bonded to the core blanket material.

E Manufacturers:

1. 3M Fire Barrier Duct Wrap 615+
2. Unifrax Fyrewrap
3. Or Approved Equal

**2.07 DUCT LINER**

A Manufacturers:

1. Armacell LLC
2. CertainTeed Corporation
3. Ductmate Industries, Inc, a DMI Company
4. K-Flex
5. Aerofoam
6. Johns Manville
7. Knauf Insulation
8. Owens Corning Corporation
9. Or Approved Equal

B Elastomeric Foam Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.

1. Minimum Service Temperature: Minus 40 degrees F.
2. Maximum Service Temperature: 180 degrees F.
3. Fungal Resistance: No growth when tested according to ASTM G21.
4. Bacteria Resistance: No growth when tested according to ASTM G22.
5. Apparent Thermal Conductivity: Maximum of 0.28 at 75 degrees F.
6. Minimum Noise Reduction Coefficients:
   a. 1 inch Thickness: 0.40.
   b. 1-1/2 inches Thickness: 0.50.
   c. 2 inch Thickness: 0.60.
7. Erosion Resistance: Does not show evidence of breaking away, flaking off, or delamination at velocities of 10,000 fpm when tested in accordance with ASTM C1071.
8. Connection: Waterproof vapor barrier adhesive.
9. Made with EPA registered Microban® antimicrobial product protection.

C Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation. Comply with ASTM C916.

D Polyester Inuslation:

1. Minimum Service Temperature: Minus 40 degrees F.
2. Maximum Service Temperature: 220 degrees F.
3. Fungal Resistance: No growth when tested according to ASTM G21.
4. Bacteria Resistance: No growth when tested according to ASTM G22.
5. Apparent Thermal Conductivity: Maximum of 0.28 at 75 degrees F.
6. Minimum Noise Reduction Coefficients:
   a. 1 inch Thickness: 0.6
   b. 1.5 inch Thickness: 0.7

7. Erosion Resistance: Does not show evidence of breaking away, flaking off, or delamination at velocities of 10,000 fpm per ASTM C1071.

E Adhesive: Waterproof, fire-retardant type, ASTM C916.
1. Manufacturers:
   a. Design Polymerics; DP 2502 Water Based, Low VOC, Duct Liner Adhesive
   b. Vimasco Corporation
   c. ITW Ultratack
   d. RCD #5 Ductliner Adhesive

F Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.
1. Manufacturers:
   a. Elgen Manufacturing Company, Inc; Peel and Press Insulation Hangers

## PART 3 EXECUTION

### 3.01 EXAMINATION

A Test ductwork for design pressure prior to applying insulation materials.

B Verify that surfaces are clean, foreign material removed, and dry.

### 3.02 INSTALLATION

A Install in accordance with manufacturer's instructions.

B Insulate all supply diffusers and ducted return grilles with 2" R6 Duct Wrap. Cut diffusers so there is a folder 2" lap on all four sides. Take with FSK tape where insulated flex meets duct insulation so there are no raw edges of fiberglass.

C Use of duct liner shall be limited to transfer ducts only.

D Install multiple layers of insulation with longitudinal and end seams staggered.

E Install insulation with least number of joints practical.

F The duct liner ends of all transfer ducts shall receive a channel nosing - 1" x liner thickeness x 1", mechanically secured to the sheet metal duct in accordance with NAIMA fabrication standards.

G Insulated Ducts Conveying Air Below Ambient Temperature:
1. Insulation on all pipes or ducts conveying air or liquids below the ambient temperature is required to have a continuous vapor barrier. On all insulation with a vapor barrier, seal the joints, duct wrap seams, vapor retarder (ASJ) film seams and penetrations in insulation at hangers, supports, anchors, and other projections with a vapor-barrier coating/mastic as specified in the individual insulation sections.
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 coating/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.
5. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

H Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces: Provide rigid fiberglass board insulation and finish with canvas jacket sized for finish painting.

I Exterior Applications: Provide rigid polyisocyanurate board insulation with vapor barrier jacket. Provide rigid polyiso board insulation and cover with with calked aluminum jacket with seams located on bottom side of horizontal duct section.

J External Duct Wrap Insulation Application:
1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
2. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers. Spacers shall be heavy density insulation board material. Refer to MICA 8th edition Plate 3-640.
3. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
4. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

**3.03 SCHEDULES**

A All supply, outside air, and return air ductwork shall be completely insulated, unless otherwise noted on the plans. Insulation shall completely cover flexible connections. Insulation shall be minimum 2.5 inch thick or the thickness required to meet the R-values below.

B All insulation within the building envelope, except in the attic (where applicable), shall have a minimum R-value of 6.0 based on installed thickness. Any insulation wrap or board installed outside the building envelope or in an attic, shall have a minimum R-value of 8.0 based on installed thickness.

C All exhaust duct associated with any unit having energy recovery (enthlpay wheel, enthalpy plate, run around loop, etc.) shall be insulated to R6.0 inside the building and R8.0 outside the building.

D Exhaust and Relief Ducts Within 10 ft of Exterior Openings or Building Envelope Penetrations: minimum R-value of 6.0 based on installed thickness.

**END OF SECTION 23 07 13**

# SECTION 23 07 19
# HVAC PIPING INSULATION

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Piping insulation.
B Flexible removable and reusable blanket insulation.
C Jacketing and accessories.

### 1.02 RELATED REQUIREMENTS

A Section 07 84 00 - Firestopping.

### 1.03 REFERENCE STANDARDS

A ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
B ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).
C ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2019).
D ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2019).
E ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.
F ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.
G ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).
H ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation; 2023.
I ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation; 2021.
J ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023c.
K ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).
L ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013 (Reapproved 2021).
M SAE AMS3779 - Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant, Aluminum Coated Glass Cloth; 2016b.
N MICA - Midwest Insulation Contractors Association National Commercial & Industrial Insulation Standards; 8th Edition.
O UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

### 1.04 SUBMITTALS

A Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations. Provide the following information:
   1. Schedule indicating insulation type, thickness, and location for each service (equipment, duct, and pipe with size).
   2. Density
   3. Compressive Strength
   4. "k" value at 75 deg F
   5. Nominal "R" value
   6. Mean temperature range
   7. Flame spread rating
B Shop Drawings: Show details for the following:
   1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Attachment and covering of heat tracing inside insulation.
   3. Insulation application at pipe expansion joints for each type of insulation.
   4. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.

5. Application of field-applied jackets.

C Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

D Provide plates from MICA 8th edition manual for each insulation system on the project as part of the submittals. The plates for each system shall be filled out by the insulating contractor for each product being used.

**1.05 QUALITY ASSURANCE**

A Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum five years of experience.

**1.06 DELIVERY, STORAGE, AND HANDLING**

A Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

B Store insulation in original wrapping and protect from weather and construction traffic. Protect insulation against dirt, water, chemical, and mechanical damage.

**1.07 FIELD CONDITIONS**

A Maintain ambient conditions required by manufacturers of each product.

B Maintain temperature before, during, and after installation for minimum of 24 hours.

C Insulation shall not be installed until all testing and inspection of pipe, duct, vessel, etc. has been completed and approved by Engineer/Owner’s representative.

D Replace insulation damaged by either moisture or other means. Insulation which has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also replace any materials damaged by the condensation.

**PART 2 PRODUCTS**

**2.01 REGULATORY REQUIREMENTS**

A Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.

**2.02 GLASS FIBER, RIGID**

A Manufacturers:

1. CertainTeed Corporation
2. Johns Manville Corporation
3. Knauf Insulation
4. Owens Corning Corporation
5. Manson Insulation
6. Or Approved Equal

B Insulation: ASTM C547and ASTM C795; rigid molded, noncombustible.

1. K Value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum Service Temperature: 850 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.

C Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

D Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E Vapor Barrier Lap Adhesive: Compatible with insulation.

F Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

G Fibrous Glass Fabric:

1. Cloth: Untreated; 9 oz/sq yd weight.
2. Blanket: 1.0 pcf density.
3. Weave: 5 by 5.

H Indoor Vapor Barrier Finish:

1. Cloth: Untreated; 9 oz/sq yd weight.
2. Vinyl emulsion type acrylic, compatible with insulation, white color.

I Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

J Insulating Cement: ASTM C449.

**2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION**

A Manufacturers:
1. Aeroflex USA, Inc
2. Armacell LLC
3. K-Flex USA LLC
4. Or Approved Equal

B Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
1. Minimum Service Temperature: Minus 40 degrees F.
2. Maximum Service Temperature: 180 degrees F.
3. Connection: Waterproof vapor barrier adhesive.

C Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

**2.04 JACKETING AND ACCESSORIES**

A PVC Plastic.
1. Manufacturers:
   a. Johns Manville Corporation
   b. Speedline Corporation
   c. Knauf Insulation
   d. Proto PVC Corp
   e. Or Approved Equal
2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
   a. Minimum Service Temperature: 0 degrees F.
   b. Maximum Service Temperature: 150 degrees F.
   c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
   d. Thickness: 30 mil.
   e. Connections: Brush on welding adhesive.
3. Covering Adhesive Mastic: Compatible with insulation.
4. Color: Jacketing shall be color coded per the following:
   a. Hot Water Supply/Return Medium Red
   b. Makeup Water Green
   c. Refrigerant Gray

B Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire-retardant lagging adhesive.
1. Lagging Adhesive: Compatible with insulation.
   a. Manufacturers:
      1) Vimasco Corporation:
      2) GLT Products

C Aluminum Jacket:
1. Manufacturers:
   a. Alumaguard.
   b. ITW.
2. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
3. Thickness: 0.016 inch sheet.
4. Finish: Embossed.
5. Joining: Longitudinal slip joints and 2 inch laps.
6. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.
7. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

D Reinforced Tape:
1. FSK tape suitable for sealing seams between insulation, insulated pipe bends, and fittings resulting in a tight, smooth surface without wrinkles.
2. Comply with UL 723, ASTM E84.
3. Moisture Vapor Permeability: 0.00 perm inch, when tested in accordance with ASTM E96/E96M.
4. Finish: Match insulation.

E Plain Foil Tape:
1. Aluminum foil with pressure-sensitive adhesive on paper release liner.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.

B Verify that surfaces are clean and dry, with foreign material removed.

### 3.02 INSTALLATION

A Install in accordance with manufacturer's instructions and the MICA manual 8th edition. In cases of conflict, the more stringent instructions shall apply.

B Where existing piping insulation is either removed or damaged during construction, it shall be reinsulated per these specifications.

C Where insulation thickness exceeds 3 inches, the insulation shall be two layers. Secure first layer before installing the next layer and stagger the joints.

D Install multiple layers of insulation with longitudinal and end seams staggered.

E 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.

F Install insulation with least number of joints practical.

G Exposed Piping: Locate insulation and cover seams in least visible locations.

H Insulated Pipes Conveying Fluids Below Ambient Temperature:
1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
2. Insulation on all pipes or ducts conveying air or liquids below the ambient temperature is required to have a continuous vapor barrier. On all insulation with a vapor barrier, seal the joints, duct wrap seams, vapor retarder (ASJ) film seams and penetrations in insulation at hangers, supports, anchors, and other projections with a vapor-barrier coating/mastic as specified in the individual insulation sections.
3. 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 coating/mastic.
4. 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.
5. 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.

I For hot piping conveying fluids over 120 degrees F, insulate flanges and unions at equipment.

J Glass Fiber Insulated Pipes Conveying Fluids Above Ambient Temperature:
1. Provide standard jackets, with vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
2. Insulate fittings and joints with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

K Inserts and Shields:
1. Shields: Galvanized steel, 20 gauge, one half the circumference of the insulation, and a minimum of 12 inches long, between pipe hangers or pipe hanger rolls and inserts.
2. Insert location: Between support shield and piping and under the finish jacket.
3. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.

4. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

L Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 07 84 00.

M Pipe Exposed in Mechanical Equipment Rooms: Finish with PVC jacket color coded to piping system. Refer to 23 05 53 for colors.

N Pipe Exposed in Finished Spaces: Finish with canvas jacket sized for finish painting. Canvas shall be coated twice with Foster fireproof lagging to ensure specified flame and smoke spread ratings.

O For refrigerant line sets and condensate piping exposed to view serving wall mounted units, provide lineset cover system. Speedichannel by DiversiTech, Hide-A-Line by DuctlessAire, or equivalent by Inaba Denko.

P Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Provide with 0.016 inch aluminum rolled jacket. Cover with aluminum jacket with aluminum bands 12 inches on center and at each butt joint located on bottom side of horizontal piping. Fittings shall be covered with two piece factory fabricated "ELL-JACS."

Q Buried Piping: Provide factory-fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with 1 mil, 0.001 inch thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with polyester film.

R Heat Traced Piping: All piping exposed outdoors shall be wrapped with electric trace before insulation is applied. Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

S All exposed piping surfaces, insulation, supports, etc., shall be painted with two coats of oil base paint. Color shall be selected by the Owner.

T Insulation systems shall be installed per the applicable plate from the MICA manual 8th edition:

1. Pre-formed Pipe Insulation Single Layer Construction: Plate 1-100
2. Flexible Foam Insulation: Plate 1-200
3. Field applied Metal Jacketing: Plate 1-400
4. Non-metallic sealed jacketing systems: PVC, etc: Plate 1-510
5. Split Ring Hangers: Plate 1-600
6. Clevis Hanger with High Density Inserts: Plate 1-610
7. Pre-Insulated Pipe Support, Standoff Clamp: Plate 1-640
8. Vapor Stop (Dam) - Pipe: Plate 1-660
9. Refrigerant and Low Temperature: Plate 1-801
10. Traced Piping: Plate 1-900
11. Pre-formed Elbow Insulation: Plate 2-100
12. Mechanical Fitting Field Fabricated: Plate 2-116
13. Pre-formed or Fabricated Tee Insulation: Plate 2-120
14. Field or Factory-Fabricated Valve Insulation: Plate 2-130
15. In-line Flange Insulation Built-up and Beveled: Plate 2-135
16. Flexible Foam Fittings: 90s and 45s: Plate 2-200
17. Flexible Foam Fittings, Ts: 2-220
18. Flexible Foam Ts: Plate 2-225
19. PVC/Insert Valve Insulation: Plate 2-530
20. PVC/Insert Mechanical Coupling on In-line Flange: Plate 2-535
21. Non-metallic Jackets: Fitting and Valve Insulation Sealed Jacketing Systems: Plate 2-536
22. PVC End Cap Over Insulation: 2-540
23. Vapor Stop (Dam) - Fittings: Plate 2-660
24. Large Diameter Vessels Block and Blanket Insulation: Plate 4-100
25. Small Diameter Vessels: Plate 4-120
26. Large Diameter Horizontal Vessels: Plate 4-140
27. Vessels, Flexible Foam Sheets: 4-200

28. Flexible Foam for Low Temperature Equipment: 4-210
29. Vapor Stop (Dam) - Equipment: 4-660

**3.03 SCHEDULE**

A Hot Water:
1. Piping 1.5 inches in diameter and smaller shall have minimum 1.5 inch thick insulation.
2. Piping 2.0 inches or larger in diameter shall have minimum 2.0 inch thick insulation.
3. Hot Water Piping exposed to outdoor air shall have minimum 2.5 inch thick insulation.
4. Hot water piping insulation shall be fiberglass.

B Makeup Water (from domestic water):
1. Insulate all makeup water lines with 0.5" thick closed cell insulation.

C Condensate
1. Condensate lines shall be insulated with 1.0 inch thick closed cell insulation. The insulation shall extend from the connection on the unit until it either terminates at a floor drain or other indirect waste receptor, or turns underground.

D Refrigerant
1. Refrigerant lines shall be insulated with 1.5 inch thick closed cell elastomeric foam insulation. Both gas and liquid lines should be insulated.

**END OF SECTION 23 07 19**

**SECTION 23 08 00**
**COMMISSIONING OF HVAC**

## PART 1 GENERAL

### 1.01 SUMMARY

A See Section 01 91 13 - General Commissioning Requirements for overall objectives; comply with the requirements of Section 01 91 13.

B This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

C The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.

D The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:

1. Control system.
2. Major and minor equipment items.
3. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

E The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

### 1.02 REFERENCE STANDARDS

A ASHRAE Guideline 1.1 - HVAC&R Technical Requirements for the Commissioning Process; 2007, with Errata (2012).

### 1.03 SUBMITTALS

A Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B Draft Prefunctional Checklists and Functional Test Procedures for Control System: Detailed written plan indicating the procedures to be followed to test, checkout and adjust the control system prior to full system Functional Testing; include at least the following for each type of equipment controlled:

1. System name.
2. List of devices.
3. Step-by-step procedures for testing each controller after installation, including:
   a. Process of verifying proper hardware and wiring installation.
   b. Process of downloading programs to local controllers and verifying that they are addressed correctly.
   c. Process of performing operational checks of each controlled component.
   d. Plan and process for calibrating valve and damper actuators and all sensors.
   e. Description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.
4. Copy of proposed log and field checkout sheets to be used to document the process; include space for initial and final read values during calibration of each point and space to specifically indicate when a sensor or controller has “passed” and is operating within the contract parameters.
5. Description of the instrumentation required for testing.
6. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the Commissioning Authority and TAB contractor for this determination.

C Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.

D HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:

1. Specific step-by-step 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. Provide an index and clear table of contents. Include the detailed technical manual for programming

and customizing control loops and algorithms.

2. Full as-built set of control drawings.
3. Full as-built sequence of operations for each piece of equipment.
4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
    a. Floor.
    b. Room number.
    c. Room name.
    d. Air handler unit ID.
    e. Reference drawing number.
    f. Air terminal unit tag ID.
    g. Heating and/or cooling valve tag ID.
    h. Minimum air flow rate.
    i. Maximum air flow rate.
5. Full print out of all schedules and set points after testing and acceptance of the system.
6. Full as-built print out of software program.
7. Electronic copy on disk of the entire program for this facility.
8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
10. Control equipment component submittals, parts lists, etc.
11. Warranty requirements.
12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
13. Organize and subdivide the manual 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 and/or 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).

E Project Record Documents: See Section 01 78 00 for additional requirements.

1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.

F Draft Training Plan: In addition to requirements specified in Section 01 79 00, include:

1. Follow the recommendations of ASHRAE Guideline 1.1.
2. Control system manufacturer's recommended training.
3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.

G Training Manuals: See Section 01 79 00 for additional requirements.

1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

## PART 2 PRODUCTS

### 2.01 TEST EQUIPMENT

A Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

## PART 3 EXECUTION

### 3.01 PREPARATION

A Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.

B Furnish additional information requested by the Commissioning Authority.

C Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.

D Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.

E Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.

F Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.

G Provide temperature and pressure taps in accordance with Contract Documents.

### 3.02 INSPECTING AND TESTING - GENERAL

A Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.

B Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.

C Provide two-way radios for use during the testing.

D Valve/Damper Stroke Setup and Check:

1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
2. Set pump/fan to normal operating mode.
3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
4. Command valve/damper open; verify position is full open and adjust output signal as required.
5. Command valve/damper to a few intermediate positions.
6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

E Isolation Valve or System Valve Leak Check: For valves not by coils.

1. With full pressure in the system, command valve closed.
2. Use an ultra-sonic flow meter to detect flow or leakage.

F Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

### 3.03 TAB COORDINATION

A TAB: Testing, adjusting, and balancing of HVAC.

B Coordinate commissioning schedule with TAB schedule.

C Review the TAB plan to determine the capabilities of the control system toward completing TAB.

D Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.

E Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.

F Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

**3.04 CONTROL SYSTEM FUNCTIONAL TESTING**

A Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of Contract Documents and the detailed Sequences of Operation documentation submittal.

B Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with Contract Documents.

C Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.

D Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.

1. The scope of trend logging is partially specified; trend log up to 50 percent more points than specified at no extra cost to Owner.
2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.

E Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.

F Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.

1. Setpoint changing features and functions.
2. Sensor calibrations.

G Demonstrate to the Commissioning Authority:

1. That all specified functions and features are set up, debugged and fully operable.
2. That scheduling features are fully functional and setup, including holidays.
3. That all graphic screens and value readouts are completed.
4. Correct date and time setting in central computer.
5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to Owner.
6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to Owner.
7. Power failure and battery backup and power-up restart functions.
8. Global commands features.
9. Security and access codes.
10. Occupant over-rides (manual, telephone, key, keypad, etc.).
11. O&M schedules and alarms.
12. Occupancy sensors and controls.
13. All control strategies and sequences not tested during controlled equipment testing.

H If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

**3.05 OPERATION AND MAINTENANCE MANUALS**

A See Section 01 78 00 for additional requirements.

B Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

C Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D Commissioning Authority will add commissioning records to manuals after submission to Owner.

**3.06 DEMONSTRATION AND TRAINING**

A See Section 01 79 00 for additional requirements.

B Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop

demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

C These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.

D Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned. Provide the following minimum durations of training:

E TAB Review: Instruct Owner's personnel for minimum ____ hours, after completion of TAB, on the following:

1. Review final TAB report, explaining the layout and meanings of each data type.
2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
5. Other salient information that may be useful for facility operations, relative to TAB.

F HVAC Control System Training: Perform training in at least three phases:

1. Phase 1 - Basic Control System: Provide minimum of 8 hours of actual training on the control system itself. Upon completion of training, each attendee, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
   a. This training may be held on-site or at the manufacturer's facility.
   b. If held off-site, the training may occur prior to final completion of the system installation.
   c. For off-site training, Contractor shall pay expenses of up to two attendees.
2. Phase 2 - Integrating with HVAC Systems: Provide minimum of 8 hours of on-site, hands-on training after completion of Functional Testing. Include instruction on:
   a. The specific hardware configuration of installed systems in this facility and specific instruction for operating the installed system, including interfaces with other systems, if any.
   b. 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.
   c. Trend logging and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends; provide practice in setting up trend logging and monitoring during training session.
   d. Every display screen, allowing time for questions.
   e. Point database entry and modifications.
3. Phase 3 - Post-Occupancy: Six months after occupancy conduct minimum of 8 hours of training. Tailor training session to questions and topics solicited beforehand from Owner. Also be prepared to address topics brought up and answer questions concerning operation of the system.

G Provide the services of manufacturer representatives to assist instructors where necessary.

H Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

**END OF SECTION 23 08 00**

**SECTION 23 09 13**
**INSTRUMENTATION AND CONTROL DEVICES FOR HVAC**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Control panels.
B Control Valves:
1. Ball valves with factory-mounted actuators.
2. Globe valves with factory-mounted actuators.
3. Butterfly valves with factory-mounted actuators.
4. Electronic valve operators.
C Dampers.
D Damper Operators:
1. Electric operators.
E Humidistats:
1. Room humidistats.
2. Limit duct humidistats.
F Wall-, Surface-, and Duct-Mounted Sensors:
1. Temperature sensors.
2. Humidity sensors.
3. IAQ (indoor air quality) sensors.
4. Airflow meters; pitot tubes.
5. Damper position indicators.
6. Carbon monoxide sensors.
7. Carbon dioxide sensors.
G Thermostats:
1. Electric thermostats.
2. Freezestats.
3. Room-mount thermostat accessories.
4. Outdoor-reset thermostats.
5. Immersion thermostats.
6. Airstream thermostats.
7. Electric high/low limit duct thermostats.
H Fan and pump motor run-status monitoring.
I Pipe-Mounted Sensors and Transmitters:
1. Temperature sensors.
2. Pressure transmitters.
3. Differential pressure transmitters.

### 1.02 RELATED REQUIREMENTS

A Section 23 05 19 - Meters and Gauges for HVAC Piping: Thermometer sockets and gauge taps.
B Section 23 21 13 - Hydronic Piping: Installation of control valves, flow switches, temperature sensor sockets, and gauge taps.
C Section 23 21 14 - Hydronic Specialties.
D Section 23 33 00 - Air Duct Accessories.
E Section 25 35 13 - Integrated Automation Actuators and Operators.
F Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.
G Section 26 27 26 - Wiring Devices: Elevation of exposed components.

### 1.03 REFERENCE STANDARDS

A ANSI/FCI 70-2 - Control Valve Seat Leakage; 2021.
B ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks; 2020, with Errata (2023).
C NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
D NEMA DC 3 - Residential Controls - Electrical Wall-Mounted Room Thermostats; 2013.

E NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

F ODVA (CIP) - The Common Industrial Protocol (CIP) Standards: EtherNet/IP, DeviceNet, ControlNet, and CompoNet; Current Edition.

G UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

**1.04 SUBMITTALS**

A See Section 01 30 00 - Administrative Requirements for submittal procedures.

B Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

C Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

D Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

**PART 2 PRODUCTS**

**2.01 EQUIPMENT - GENERAL**

A Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

**2.02 CONTROL PANELS**

A Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face.

B NEMA 250, general purpose utility enclosures with enameled finished face panel.

C Provide common keying for all panels.

**2.03 CONTROL VALVES**

A Ball Valves with Factory-Mounted Actuators:

1. Manufacturers:
    a. Belimo Aircontrols (USA), Inc: www.belimo.com/#sle.
    b. Johnson Controls International, PLC: www.johnsoncontrols.com/#sle.
    c. Schneider Electric: www.schneider-electric.us/#sle.
2. Service: Use for hot water.
3. Flow Characteristic: Include 2-way, 3-way diverting, and 3-way mixing operation configured to fail normally closed (NC).
4. Replacements in Kind: Provide pressure-independent type.
5. Rangeability: 500 to 1.
6. ANSI Rating: Class 150.
7. Leakage: Class IV (0.1 percent of rated capacity) per ANSI/FCI 70-2.
8. Body Size:
    a. Under 2-1/2 inches:
        1) Connection: NPT.
        2) Materials:
            (a) Body: Brass.
            (b) Flanges: Ductile iron.
            (c) Ball: Chrome-plated brass.
            (d) Stem: Nickel-plated brass.
            (e) Seat: Graphite-reinforced PTFE with EPDM O-Ring backing.
            (f) Stem Seal: EPDM O-Rings.
            (g) Flow Control Disk: Thermoplastic synthetic-resin.
    b. Service Temperature:
        1) Fluid Side: 0 to 284 degrees F liquid or 25 psig steam.
        2) Ambient Side: From minus 4 to 122 degrees F.
9. Actuator Requirements:

a. Assembly: Factory-mounted.
b. Input: 0 to 5 VDC configured for proportional control.
c. Accessories: Provide with valve position indicator and manual override.

B Globe Valves with Factory-Mounted Actuators:
1. Manufacturers:
a. Honeywell International, Inc: buildingcontrols.honeywell.com/#sle.
b. Johnson Controls International, PLC: www.johnsoncontrols.com/#sle.
c. Schneider Electric: www.schneider-electric.us/#sle.
2. Up to 2 inches: Bronze body, bronze trim, rising stem, renewable composition disc, screwed ends with backseating capacity repackable under pressure.
3. Over 2 inches: Iron body, bronze trim, rising stem, plug-type disc, flanged ends, renewable seat and disc.
4. Hydronic Systems:
a. Rate for service pressure of 125 psig at 250 degrees F.
b. Replaceable plugs and seats of stainless steel.
c. Size for 3 psig maximum pressure drop at design flow rate.
d. Provide two-way valves with equal percentage characteristics and three-way valves with linear characteristics. Size two-way valve operators to close valves against pump shut-off head.

C Electronic Valve Actuators:
1. Manufacturers:
a. Honeywell International, Inc: buildingcontrols.honeywell.com/#sle.
b. Johnson Controls International, PLC: www.johnsoncontrols.com/#sle.
c. Schneider Electric: www.schneider-electric.us/#sle.
2. Valves shall spring return to normal position as indicated on freeze, fire, or temperature protection.
3. Select operator for full shut-off at maximum pump differential pressure.

**2.04 DAMPERS**

A See Section 23 33 00 for dampers and this section for actuators and operators.

**2.05 DAMPER OPERATORS**

A General:
1. Provide actuators with torque capacity sized for minimum of 20 percent greater than maximum design stream velocity and hold tight seal against maximum system pressures.
2. Provide spring return for two position control and for fail safe operation.
3. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
4. Provide one operator for maximum 36 sq ft damper section.
5. See Section 25 35 13 for field-mount damper actuators and operators.

B Electric Operators:
1. Manufacturers:
a. Honeywell International, Inc: buildingcontrols.honeywell.com/#sle.
b. Johnson Controls International, PLC: www.johnsoncontrols.com/#sle.
c. Schneider Electric: www.schneider-electric.us/#sle.
2. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch.

**2.06 HUMIDISTATS**

A Room Humidistats:
1. Manufacturers:
a. Honeywell International, Inc: buildingcontrols.honeywell.com/#sle.
b. Johnson Controls International, PLC: www.johnsoncontrols.com/#sle.
c. Siemens Industry, Inc: www.siemens.com/#sle.
d. Veris Industries: www.veris.com/#sle.
e. Schneider Electric.
2. Wall mounted, proportioning type.
3. Throttling Range: Adjustable 2 percent relative humidity.
4. Operating Range: 30 to 80 percent.

5. Maximum Temperature: ____ degrees F.

B Limit Duct Humidistats:

1. Manufacturers:
   a. Honeywell International, Inc: buildingcontrols.honeywell.com/#sle.
   b. Johnson Controls International, PLC: www.johnsoncontrols.com/#sle.
   c. Siemens Industry, Inc: www.siemens.com/#sle.
   d. Veris Industries: www.veris.com/#sle.
2. Insertion, two-position type.
3. Throttling Range: Adjustable 2 percent relative humidity.
4. Operating Range: 20 to 80 percent.
5. Maximum Temperature: 150 degrees F.

**2.07 WALL-, SURFACE-, AND DUCT-MOUNT SENSORS**

A Temperature Sensors:

1. Manufacturers:
   a. Dwyer Instruments Inc: www.dwyer-inst.com/#sle.
   b. Johnson Controls International, PLC: www.johnsoncontrols.com/#sle.
   c. Veris Industries: www.veris.com/#sle.
   d. Schneider Electric.
2. Use thermistor or RTD type temperature sensing elements with characteristics resistant to moisture, vibration, and other conditions consistent with the application without affecting accuracy and life expectancy.
3. Construct RTD of nickel or platinum with base resistance of 1000 ohms at 70 degrees F.
4. 100 ohm platinum RTD is acceptable if used with project DDC controllers.
5. Temperature Sensing Device: Compatible with project DDC controllers.
6. Performance Characteristics:
   a. RTD:
      1) Room Sensor Accuracy: Plus/minus 0.50 degrees F minimum.
      2) Duct Averaging Accuracy: Plus/minus 0.50 degrees F minimum.
      3) All Other Accuracy: Plus/minus 0.75 degrees F minimum.
      4) Range: Minus 40 degrees F through 220 degrees F minimum.
   b. Temperature Transmitter:
      1) Accuracy: 0.10 degree F minimum or plus/minus 0.20 percent of span.
      2) Output: 4 to 20 mA.
   c. Sensing Range:
      1) Provide limited range sensors if required to sense the range expected for a respective point.
      2) Use RTD type sensors for extended ranges beyond minus 30 to 230 degrees F.
      3) Use temperature transmitters in conjunction with RTDs when RTDs are incompatible with DDC controller direct temperature input.
   d. Outside Air Sensors: Watertight inlet fitting shielded from direct rays of the sun.
   e. Immersion Temperature Sensors: A sensor encased in a corrosion-resistant probe with an indoor junction box service entry body.
   f. Room Temperature Sensors with Integral Digital Display:
      1) Construct for surface or wall box.
      2) Provide a four button keypad with the following capabilities:
         (a) Indication of space and outdoor temperatures.
         (b) Setpoint adjustment to accommodate room setpoint, DDC Input/Output Points List, and Sequence of Operation.
         (c) Display and control fan operation status.
         (d) Manual occupancy override and indication of occupancy status.
         (e) Controller mode status.
         (f) Password enabled setpoint and override modes.
   g. Temperature Averaging Elements:

1) Use on duct sensors for ductwork 10 sq ft or larger.
2) Use averaging elements where prone to stratification with sensor length 8 ft or 16 ft.
3) Provide for all mixed air and heating coil discharge sensors regardless of duct size.

h. Insertion Elements:
1) Use in ducts not affected by temperature stratification or smaller than 11 sq inches.

B Humidity Sensors, Duct-Mounted:
1. Manufacturers:
a. Dwyer Instruments Inc: www.dwyer-inst.com/#sle.
b. Johnson Controls International, PLC: www.johnsoncontrols.com/#sle.
c. Veris Industries; HD Series: www.veris.com/#sle.
d. Schneider Electric.
2. Digitally profiled thin-film capacitive sensor probe extended from die-cast metal, weather-proof plastic or metal housing designed for duct mounting.
3. Measuring Scale: 0 to 100 percent RH, noncondensing, temperature compensated.
4. Hardwired Output: Two-wire, 4 to 20 mA, loop powered.
5. Accuracy: Plus/minus 1 percent between 20 to 40 percent RH linear range, NIST traceable with multi-point calibration.

C IAQ (Indoor Air Quality) Sensors:
1. Manufacturers:
a. Automated Logic, a company of Carrier Global Corporation: www.automatedlogic.com/#sle.
b. Honeywell International, Inc: buildingcontrols.honeywell.com/#sle.
c. Veris Industries; CW2 Series: www.veris.com/#sle.
2. Form Factor: Surface mounted, desk mounted, or single-gang electrical-box-mounted module made of high-impact plastic or other resilient material.
3. Temperature Sensor:
a. Soild-state, integrated circuit type, 32 to 122 deg F range.
b. Accuracy: Plus/minus two percent within 0.1 deg resolution.
4. CO2 (Carbon Dioxide) Monitoring Sensor:
a. Non-dispersive infrared (NDIR) type, 0 to 100 %RH range.
b. Accuracy: Plus/minus 30 ppm within three percent of measured value.
5. Humidity Monitoring Sensor:
a. Thin-film capacitive, replaceable type, 0 to 2,000 or 5,000 ppm range, noncondensing.
b. Accuracy: Plus/minus two percent within 1.5 percent of measured value.
6. BAS, SCADA, or other Integrated Automation Link: ASHRAE Std 135 BACnet MS/TP.

D Carbon Dioxide Sensors, Duct and Wall:
1. Manufacturers:
a. Greystone Energy Systems, Inc; DES-100: www.greystoneenergy.com/#sle.
b. Macurco, a brand or Aerionics, Inc: www.macurco.com/#sle.
c. Veris Industries: www.veris.com/#sle.
2. General: Provide nondispersive infrared (NDIR), diffusion sampling CO2 sensors with integral transducers and linear output.
3. Air Temperature: Range of 32 to 122 degrees F.
4. Relative Humidity: Range of 0 to 95 percent (noncondensing).
5. Calibration Characteristics:
a. Automatically compensating algorithm for sensor drift due to sensor degradation.
b. Maximum Drift: 2 percent.
c. User calibratable with a minimum calibration interval of 5 years.
6. Construction:
a. Sensor Chamber: Noncorrosive material for neutral effect on carbon dioxide sample.
b. Provide duct mounted sensors with duct probe designed to protect sensing element from dust accumulation and mechanical damage.
c. Housing: High impact plastic.

**2.08 THERMOSTATS**

A Electric Thermostats:
1. Manufacturers:
   a. Honeywell International, Inc: buildingcontrols.honeywell.com/#sle.
   b. Johnson Controls International, PLC: www.johnsoncontrols.com/#sle.
   c. Siemens Industry, Inc: www.siemens.com/#sle.
   d. Schneider Electric.
2. Type: NEMA DC 3, 24 volts, with setback/setup temperature control.
3. Service: Cooling and heating.
4. Covers: Locking with set point adjustment, with thermometer.

B Freezestats:
1. Manufacturers:
   a. Honeywell International, Inc: buildingcontrols.honeywell.com/#sle.
   b. Johnson Controls International, PLC: www.johnsoncontrols.com/#sle.
   c. Siemens Industry, Inc: www.siemens.com/#sle.
   d. Veris Industries; TZ Series: www.veris.com/#sle.
   e. Schneider Electric.
2. Configuration: Vapor-filled capillary.
3. Probe Sensing Length: 20 feet.
4. Setpoint Adjust Control: Screw with manual reset switch.
5. Switch Type: SPDT, snap-action, form C in dust-protected enclosure.
6. Mounting: Locate on cooling coil intake side.
7. Field Interface: Connect load line-voltage to starter.
8. Electrical Rating: As indicated on drawings.

C Room-Mounted Thermostat Accessories:
1. Thermostat Covers: Brushed aluminum.
2. Insulating Bases: For thermostats located on exterior walls.

D Outdoor Reset Thermostats:
1. Remote bulb or bimetal rod and tube type, proportioning action with adjustable throttling range, adjustable setpoint.
2. Scale range: Minus 10 to 70 degrees F.

E Immersion Thermostats:
1. Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint and adjustable throttling range.

F Airstream Thermostats:
1. Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint in middle of range and adjustable throttling range.
2. Averaging service remote bulb element: 7.5 feet.

G Electric High/Low Limit Duct Thermostats:
1. Manufacturers:
   a. Honeywell International, Inc: buildingcontrols.honeywell.com/#sle.
   b. Johnson Controls International, PLC: www.johnsoncontrols.com/#sle.
   c. Siemens Industry, Inc: www.siemens.com/#sle.
   d. Schneider Electric.
   e. Substitutions: See Section 01 60 00 - Product Requirements.
2. Snap acting, single pole, single throw, manual reset switch that trips if temperature sensed across any 12 inches of bulb length is above, equal to, or below setpoint,
3. Bulb length: Minimum 20 feet.
4. Provide one thermostat for every 20 sq ft of coil surface.

**2.09 FAN AND PUMP MOTOR RUN-STATUS MONITORING**

A Current Switches:
1. Manufacturers:

a. Automation Components, Inc: www.workaci.com/#sle.
b. Functional Devices, Inc: www.functionaldevices.com/#sle.
c. Schneider Electric: www.schneider-electric.us/#sle.

2. Mini Solid-Core: 2-State, On/Off digital output of motor status with adjustable trip point to detect belt loss or mechanical failure.
3. Maximum AC Current Monitoring Value: As indicated on drawings.

**2.10 PIPE-MOUNTED SENSORS AND TRANSMITTERS**

A Temperature Sensors:

1. Manufacturers:
   a. Johnson Controls International, PLC: www.johnsoncontrols.com/#sle.
   b. Siemens Industry, Inc: www.siemens.com/#sle.
   c. Veris Industries: www.veris.com/#sle.
   d. Schneider Electric.
   e. Substitutions: See Section 01 60 00 - Product Requirements.
2. Pipe-mounted temperature probe tied to weather-resistant enclosure for direct insertion into compatible liquids or gases or inserted into intermediary thermal grease-filled pipe-well compatible with interfaced fluid.
3. Sensor Type: 1,000 ohm Platinum RTD.
4. Transmitter: Fitted within probe-interface enclosure, calibrated.
   a. Monitoring Range: 32 to 122 degrees F, adjustable.
   b. Hardwired Output: Two-wire, 4 to 20 mA, loop powered.
   c. Accuracy: Plus/minus three percent. adjustable on the transmitter end.
5. Accessories: Provide downstream PT test plug and brass pipe-well.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A Verify existing conditions before starting work.
B Verify that systems are ready to receive work.
C Beginning of installation means installer accepts existing conditions.
D Sequence work to ensure installation of components is complementary to installation of similar components in other systems.
E Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.
F Ensure installation of components is complementary to installation of similar components.
G Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

**3.02 INSTALLATION**

A Install in accordance with manufacturer's instructions.
B Check and verify location of thermostats with plans and room details before installation. Locate 60 inches above floor. Align with lighting switches and humidistats; see Section 26 27 26.
C Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.
D Provide guards on thermostats in Gymnasium..
E Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.
F Mount control panels adjacent to associated equipment on vibration free walls or free-standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.
G Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.

H Provide conduit and electrical wiring in accordance with Section 26 05 83. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

**END OF SECTION 23 09 13**

# SECTION 23 09 23
# DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A System description.
B Operator interface.
C Controllers.
D Power supplies and line filtering.
E System software.
F Controller software.
G HVAC control programs.

### 1.02 RELATED REQUIREMENTS

A Section 23 09 13 - Instrumentation and Control Devices for HVAC.
B Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

### 1.03 REFERENCE STANDARDS

A ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks; 2020, with Errata (2023).
B CTA-709.1 - Control Network Protocol Specification; 2019.
C MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests; 2019h.
D NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

### 1.04 SUBMITTALS

A See Section 01 30 00 - Administrative Requirements for submittal procedures.
B Shop Drawings:
1. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.
2. Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations. Provide demonstration digital media containing graphics.
3. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
4. Indicate description and sequence of operation of operating, user, and application software.
C Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
1. Revise shop drawings to reflect actual installation and operating sequences.
2. Include submittals data in final "Record Documents" form.
D Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

### 1.05 WARRANTY

A See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
B Provide five year manufacturer's warranty for field programmable micro-processor based units.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A Schneider Electric: www.schneider-electric.us/#sle.

### 2.02 SYSTEM DESCRIPTION

A Automatic temperature control field monitoring and control system using field programmable micro-processor based units.
B Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.
C Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

D Controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, and the like when directly connected to the control units. Individual terminal unit control is specified in Section 23 09 13.

E Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

F Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

**2.03 OPERATOR INTERFACE**

A PC Based Work Station:

B Workstation, controllers, and control backbone to communicate using BACnet protocol and addressing.

C Hardware:

1. Desktop:
   a. Computer(s) and display(s) to be provided by DDC controls manufacturer.
   b. Quantity: Provide allowance for 1 computer(s).
   c. Minimum RAM: 32 GB.
   d. Minimum Processing Speed: 16 CORE.
   e. Minimum Hard Drive Memory: 512 GB.
   f. Drives: 2.
   g. Ports: 4.
   h. Monitor: 19".
   i. Location(s): As indicated on the drawings.
   j. Network Connection:
      1) Ethernet interface card.
      2) Minimum Speed: _____.
   k. System Printer:
      1) Printer(s) to be provided by DDC controls manufacturer.
      2) Quantity: Provide allowance for 1 computers.
      3) Type: _____.
      4) Locations(s): As indicated on the drawings.

**2.04 CONTROLLERS**

A Building Controllers:

1. General:
   a. Manage global strategies by one or more, independent, standalone, microprocessor based controllers.
   b. Provide sufficient memory to support controller's operating system, database, and programming requirements.
   c. Share data between networked controllers.
   d. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
   e. Utilize real-time clock for scheduling.
   f. Continuously check processor status and memory circuits for abnormal operation.
   g. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
   h. Communication with other network devices to be based on assigned protocol.
2. Communication:
   a. Controller to reside on a BACnet network using ISO 8802-3 (ETHERNET) Data Link/Physical layer protocol.
   b. Perform routing when connected to a network of custom application and application specific controllers.
   c. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.

3. Anticipated Environmental Ambient Conditions:
    a. Outdoors and/or in Wet Ambient Conditions:
        1) Mount within waterproof enclosures.
        2) Rated for operation at 40 to 150 degrees F.
    b. Conditioned Space:
        1) Mount within dustproof enclosures.
        2) Rated for operation at 32 to 120 degrees F.
4. Provisions for Serviceability:
    a. Diagnostic LEDs for power, communication, and processor.
    b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
6. Power and Noise Immunity:
    a. Maintain operation at 90 to 110 percent of nominal voltage rating.
    b. Perform orderly shutdown below 80 percent of nominal voltage.
    c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

B Application Specific Controllers:

1. General:
    a. Not fully user programmable, microprocessor based controllers dedicated to control specific equipment.
    b. Customized for operation within the confines of equipment served.
    c. Communication with other network devices to be based on assigned protocol.
2. Communication:
    a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.
    b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
3. Anticipated Environmental Ambient Conditions:
    a. Outdoors and/or in Wet Ambient Conditions:
        1) Mount within waterproof enclosures.
        2) Rated for operation at 40 to 150 degrees F.
    b. Conditioned Space:
        1) Mount within dustproof enclosures.
        2) Rated for operation at 32 to 120 degrees F.
4. Provisions for Serviceability:
    a. Diagnostic LEDs for power, communication, and processor.
    b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
6. Power and Noise Immunity:
    a. Maintain operation at 90 to 110 percent of nominal voltage rating.
    b. Perform orderly shutdown below 80 percent of nominal voltage.
    c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 feet.

C Input/Output Interface:

1. Hardwired inputs and outputs tie into the DDC system through building, custom application, or application specific controllers.
2. All Input/Output Points:
    a. Protect controller from damage resulting from any point short-circuiting or grounding and from voltage up to 24 volts of any duration.

b. Provide universal type for building and custom application controllers where input or output is software designated as either binary or analog type with appropriate properties.

3. Binary Inputs:
   a. Allow monitoring of On/Off signals from remote devices.
   b. Provide wetting current of 12 mA minimum, compatible with commonly available control devices and protected against the effects of contact bounce and noise.
   c. Sense dry contact closure with power provided only by the controller.
4. Analog Inputs:
   a. Allow for monitoring of low voltage 0 to 10 VDC, 4 to 20 mA current, or resistance signals (thermistor, RTD).
   b. Compatible with and field configurable to commonly available sensing devices.
5. Binary Outputs:
   a. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.
   b. Outputs provided with three position (On/Off/Auto) override switches.
   c. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.
6. Analog Outputs:
   a. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.
   b. Provide status lights and two position (AUTO/MANUAL) switch for building and custom application controllers with manually adjustable potentiometer for manual override on building and custom application controllers.
   c. Drift to not exceed 0.4 percent of range per year.
7. Tri State Outputs:
   a. Coordinate two binary outputs to control three point, floating type, electronic actuators without feedback.
   b. Limit the use of three point, floating devices to the following zone and terminal unit control applications:
   c. Control algorithms run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.
8. System Object Capacity:
   a. System size to be expandable to twice the number of input output objects required by providing additional controllers, including associated devices and wiring.
   b. Hardware additions or software revisions for the installed operator interfaces are not to be required for future, system expansions.

**2.05 POWER SUPPLIES AND LINE FILTERING**

A Power Supplies:
1. Provide UL listed control transformers with Class 2 current limiting type or over-current protection in both primary and secondary circuits for Class 2 service as required by the NEC.
2. Limit connected loads to 80 percent of rated capacity.
3. Match DC power supply to current output and voltage requirements.
4. Unit to be full wave rectifier type with output ripple of 5.0 mV maximum peak to peak.
5. Regulation to be 1 percent combined line and load with 100 microsecond response time for 50 percent load changes.
6. Provide over-voltage and over-current protection to withstand a 150 percent current overload for 3 seconds minimum without trip-out or failure.
7. Operational Ambient Conditions: 32 to 120 degrees F.
8. EM/RF meets FCC Class B and VDE 0871 for Class B and MIL-STD-810 for shock and vibration.
9. Line voltage units UL recognized and CSA approved.

B Power Line Filtering:
1. Provide external or internal transient voltage and surge suppression component for all workstations and controllers.
2. Minimum surge protection attributes:

a. Dielectric strength of 1000 volts minimum.
b. Response time of 10 nanoseconds or less.
c. Transverse mode noise attenuation of 65 dB or greater.
d. Common mode noise attenuation of 150 dB or greater at 40 to 100 Hz.

**2.06 SYSTEM SOFTWARE**

A Operating System:
1. Concurrent, multi-tasking capability.
   a. Common Software Applications Supported: Microsoft Excel.
2. System Graphics:
   a. Allow up to 10 graphic screens, simultaneously displayed for comparison and monitoring of system status.
   b. Animation displayed by shifting image files based on object status.
   c. Provide method for operator with password to perform the following:
      1) Move between, change size, and change location of graphic displays.
      2) Modify on-line.
      3) Add, delete, or change dynamic objects consisting of:
         (a) Analog and binary values.
         (b) Dynamic text.
         (c) Static text.
         (d) Animation files.
3. Custom Graphics Generation Package:
   a. Create, modify, and save graphic files and visio format graphics in PCX formats.
   b. HTML graphics to support web browser compatible formats.
   c. Capture or convert graphics from AutoCAD.
4. Standard HVAC Graphics Library:
   a. HVAC Equipment:
      1) Air Handlers.
   b. Ancillary Equipment:
      1) Fans.
      2) Coils.
      3) Dampers.

B Workstation System Applications:
1. Automatic System Database Save and Restore Functions:
   a. Current database copy of each Building Controller is automatically stored on hard disk.
   b. Automatic update occurs upon change in any system panel.
   c. In the event of database loss in any system panel, the first workstation to detect the loss automatically restores the database for that panel unless disabled by the operator.
2. Manual System Database Save and Restore Functions by Operator with Password Clearance:
   a. Save database from any system panel.
   b. Clear a panel database.
   c. Initiate a download of a specified database to any system panel.
3. Software provided allows system configuration and future changes or additions by operators under proper password protection.
4. On-line Help:
   a. Context-sensitive system assists operator in operation and editing.
   b. Available for all applications.
   c. Relevant screen data provided for particular screen display.
   d. Additional help available via hypertext.
5. Security:
   a. Operator log-on requires user name and password to view, edit, add, or delete data.
   b. System security selectable for each operator.
   c. System supervisor sets passwords and security levels for all other operators.

d. Operator passwords to restrict functions accessible to viewing and/or changing system applications, editor, and object.
e. Automatic, operator log-off results from keyboard or mouse inactivity during user-adjustable, time period.
f. All system security data stored in encrypted format.

6. System Diagnostics:
   a. Operations Automatically Monitored:
      1) Workstations.
      2) Printers.
      3) Modems.
      4) Network connections.
      5) Building management panels.
      6) Controllers.
   b. Device failure is annunciated to the operator.
7. Alarm Processing:
   a. All system objects are configurable to "alarm in" and "alarm out" of normal state.
   b. Configurable Objects:
      1) Alarm limits.
      2) Alarm limit differentials.
      3) States.
      4) Reactions for each object.
8. Alarm Messages:
   a. Descriptor: English language.
   b. Recognizable Features:
      1) Source.
      2) Location.
      3) Nature.
9. Configurable Alarm Reactions by Workstation and Time of Day:
   a. Logging.
   b. Printing.
   c. Starting programs.
   d. Displaying messages.
   e. Dialing out to remote locations.
   f. Paging.
   g. Providing audible annunciation.
   h. Displaying specific system graphics.
10. Custom Trend Logs:
    a. Definable for any data object in the system including interval, start time, and stop time.
    b. Trend Data:
       1) Sampled and stored on the building controller panel.
       2) Archivable on hard disk.
       3) Retrievable for use in reports, spreadsheets and standard database programs.
       4) Archival on LAN accessible storage media including hard disk, tape, Raid array drive, and virtual cloud environment.
       5) Protected and encrypted format to prevent manipulation, or editing of historical data and event logs.
11. Alarm and Event Log:
    a. View all system alarms and change of states from any system location.
    b. Events listed chronologically.
    c. Operator with proper security acknowledges and clears alarms.
    d. Alarms not cleared by operator are archived to the workstation hard disk.
12. Object, Property Status and Control:

a. Provide a method to view, edit if applicable, the status of any object and property in the system.
b. Status Available by the Following Methods:
1) Menu.
2) Graphics.
3) Custom Programs.

13. Reports and Logs:
a. Reporting Package:
1) Allows operator to select, modify, or create reports.
2) Definable as to data content, format, interval, and date.
3) Archivable to hard disk.
b. Real-time logs available by type or status such as alarm, lockout, normal, etc.
c. Stored on hard disk and readily accessible by standard software applications, including spreadsheets and word processing.
d. Set to be printed on operator command or specific time(s).

14. Reports:
a. Standard:
1) Objects with current values.
2) Current alarms not locked out.
3) Disabled and overridden objects, points and SNVTs.
4) Objects in manual or automatic alarm lockout.
5) Objects in alarm lockout currently in alarm.
6) Logs:
(a) Alarm History.
(b) System messages.
(c) System events.
(d) Trends.
b. Custom:
1) Daily.
2) Weekly.
3) Monthly.
4) Annual.
5) Time and date stamped.
6) Title.
7) Facility name.
c. Tenant Override:
1) Monthly report showing total, requested, after-hours HVAC and lighting services on a daily basis for each tenant.
2) Annual report showing override usage on a monthly basis.

C Workstation Applications Editors:
1. Provide editing software for each system application at PC workstation.
2. Downloaded application is executed at controller panel.
3. Full screen editor for each application allows operator to view and change:
a. Configuration.
b. Name.
c. Control parameters.
d. Set-points.
4. Scheduling:
a. Monthly calendar indicates schedules, holidays, and exceptions.
b. Allows several related objects to be scheduled and copied to other objects or dates.
c. Start and stop times adjustable from master schedule.
5. Custom Application Programming:

a. Create, modify, debug, edit, compile, and download custom application programming during operation and without disruption of all other system applications.
b. Programming Features:
   1) English oriented language, based on BASIC, FORTRAN, C, or PASCAL syntax allowing for free form programming.
   2) Alternative language graphically based using appropriate function blocks suitable for all required functions and amenable to customizing or compounding.
   3) Insert, add, modify, and delete custom programming code that incorporates word processing features such as cut/paste and find/replace.
   4) Allows the development of independently, executing, program modules designed to enable and disable other modules.
   5) Debugging/simulation capability that displays intermediate values and/or results including syntax/execution error messages.
   6) Support for conditional statements (IF/THEN/ELSE/ELSE-F) using compound Boolean (AND, OR, and NOT) and/or relations (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.
   7) Support for floating-point arithmetic utilizing plus, minus, divide, times, square root operators; including absolute value; minimum/maximum value from a list of values for mathematical functions.
   8) Language consisting of resettable, predefined, variables representing time of day, day of the week, month of the year, date; and elapsed time in seconds, minutes, hours, and days where the variable values cab be used in IF/THEN comparisons, calculations, programming statement logic, etc.
   9) Language having predefined variables representing status and results of the system software enables, disables, and changes the set points of the controller software.

## PART 3 EXECUTION

### 3.01 INSTALLERS

A Installer List:

### 3.02 EXAMINATION

A Verify existing conditions before starting work.

B Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

### 3.03 INSTALLATION

A Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

B Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 23 09 93.

C Provide conduit and electrical wiring in accordance with Section 26 05 83. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

### 3.04 MANUFACTURER'S FIELD SERVICES

A Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

B Provide service engineer to instruct Owner's representative in operation of systems plant and equipment for 3 day period.

C Provide basic operator training for 4 persons on data display, alarm and status descriptors, requesting data, execution of commands and request of logs. Include a minimum of 40 hours dedicated instructor time. Provide training on site.

### 3.05 DEMONSTRATION AND INSTRUCTIONS

A Demonstrate complete and operating system to Owner.

### 3.06 MAINTENANCE

A See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B Provide service and maintenance of energy management and control systems for one years from Date of Substantial Completion.

C Provide two complete inspections, one in each season, to inspect, calibrate, and adjust controls as required, and submit written reports.

D Provide complete service of systems, including call backs. Make minimum of ____ complete normal inspections of approximately ____ hours duration in addition to normal service calls to inspect, calibrate, and adjust controls, and submit written reports.

**END OF SECTION 23 09 23**

# SECTION 23 21 13
# HYDRONIC PIPING

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Hydronic system requirements.
B Heating water piping, above grade.
C Heating water and glycol piping, above grade.
D Pipe hangers and supports.
E Unions, flanges, mechanical couplings, and dielectric connections.
F Valves:
1. Ball valves.
2. Check valves.
3. Pressure independent temperature control valves and balancing valves.

### 1.02 REFERENCE STANDARDS

A ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.
B ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.
C ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.
D ASME B16.15 - Cast Copper Alloy Threaded Fittings: Classes 125 and 250; 2018.
E ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
F ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
G ASME B16.34 - Valves — Flanged, Threaded, and Welding End; 2020.
H ASME B31.9 - Building Services Piping; 2020.
I ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
J ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.
K ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).
L ASTM B32 - Standard Specification for Solder Metal; 2020.
M ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
N ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.
O AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.
P AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2022).
Q MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

### 1.03 ADMINISTRATIVE REQUIREMENTS

A Coordination: Coordinate the installation of _____ with size, location and installation of service utilities.

### 1.04 SUBMITTALS

A See Section 01 30 00 - Administrative Requirements for submittal procedures.
B Welders Certificate: Include welders certification of compliance with ASME BPVC-IX.
C Product Data:
1. Include data on pipe materials, pipe fittings, valves, and accessories.
2. Provide manufacturers catalog information.

### 1.05 QUALITY ASSURANCE

A Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.
B Installer Qualifications: Company specializing in performing work of the type specified in this section, with minimum 5 years of experience.
C Provide all grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer.

D Date stamp all castings used for coupling housings, fittings, valve bodies, etc. for quality assurance and traceability.

E Welder Qualifications: Certify in accordance with ASME BPVC-IX.

1. Provide certificate of compliance from authority having jurisdiction, indicating approval of welders.

**1.06 DELIVERY, STORAGE, AND HANDLING**

A Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B Provide temporary protective coating on cast iron and steel valves.

C Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

**PART 2 PRODUCTS**

**2.01 HYDRONIC SYSTEM REQUIREMENTS**

A Comply with ASME B31.9 and applicable federal, state, and local regulations.

B Piping: Provide piping, fittings, hangers, and supports as required, as indicated, and as follows:

1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
3. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

C Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

D Valves: Provide valves where indicated:

**2.02 HEATING WATER PIPING, ABOVE GRADE**

A Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:

1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.
2. Threaded Joints: ASME B16.3, malleable iron fittings.

B Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn, using one of the following joint types:

1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
   a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
   b. Braze: AWS A5.8M/A5.8 BCuP copper/silver alloy.
2. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
3. Mechanical Press Sealed Fittings: Double pressed type complying with ASME B16.22, utilizing EPDM, nontoxic synthetic rubber sealing elements.
   a. Manufacturers:
      1) Apollo Valves: www.apollovalves.com/#sle.
      2) FNW; Copper Press: www.fnw.com/#sle.
      3) Grinnell Products: www.grinnell.com/#sle.

**2.03 PIPE HANGERS AND SUPPORTS**

A Provide hangers and supports that comply with MSS SP-58.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

**2.04 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS**

A Unions for Pipe of 2 Inches and Less:

1. Copper Pipe: Bronze, soldered joints.

B Flanges for Pipe 2 Inches and Greater:

1. Copper Piping: Bronze.

**2.05 SWING CHECK VALVES**

A Manufacturers:

1. Anvil International; _____: www.anvilintl.com/#sle.
2. Apollo Valves; _____: www.apollovalves.com/#sle.
3. Grinnell Products; _____: www.grinnell.com/#sle.

B Up To and Including 2 Inches:

1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder ends.

C Over 2 Inches:

1. Iron body, bronze or _____ trim, stainless steel, bronze, bronze faced rotating, or _____ swing disc, renewable disc and seat, flanged, grooved, or _____ ends.

## PART 3 EXECUTION

### 3.01 PREPARATION

A Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B Remove scale and dirt on inside and outside before assembly.

C Prepare piping connections to equipment using jointing system specified.

D Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E After completion, fill, clean, and treat systems. See Section 23 25 00 for additional requirements.

### 3.02 INSTALLATION

A Install in accordance with manufacturer's instructions.

B Route piping in orderly manner, parallel to building structure, and maintain gradient.

C Install piping to conserve building space and to avoid interference with use of space.

D Group piping whenever practical at common elevations.

E Slope piping and arrange to drain at low points.

**END OF SECTION 23 21 13**

# SECTION 23 23 00
# REFRIGERANT PIPING

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Piping.
B Refrigerant.
C Moisture and liquid indicators.
D Valves.
E Strainers.
F Check valves.
G Filter-driers.
H Flexible connections.
I Exterior penetration accessories.

### 1.02 RELATED REQUIREMENTS

A Section 23 07 16 - HVAC Equipment Insulation.

### 1.03 REFERENCE STANDARDS

A AHRI 710 (I-P) - Performance Rating of Liquid-Line Driers; 2009.
B AHRI 711 (SI) - Performance Rating of Liquid-Line Driers; 2009.
C AHRI 730 (I-P) - Flow Capacity Rating of Suction Line Filters and Suction Line Filter Driers; 2013 (Reapproved 2014).
D AHRI 750 - Thermostatic Refrigerant Expansion Valves; 2007.
E ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2022, with Errata (2023).
F ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.
G ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
H ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2022.
I ASME B31.9 - Building Services Piping; 2020.
J ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2023.
K AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.
L MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

### 1.04 SUBMITTALS

A See Section 01 30 00 - Administrative Requirements for submittal procedures.
B Product Data: Provide general assembly of specialties, including manufacturer's catalogue information. Provide manufacturer's catalog data including load capacity.
C Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.
D Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, and sizes.
E Test Reports: Indicate results of leak test, acid test.
F Manufacturer's Installation Instructions: Indicate support, connection requirements, and isolation for servicing.
G Designer's qualification statement.
H Installer's qualification statement.
I Project Record Documents: Record exact locations of equipment and refrigeration accessories on record drawings.

### 1.05 DELIVERY, STORAGE, AND HANDLING

A Deliver and store piping and specialties in shipping containers with labeling in place.
B Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.
C Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

## PART 2 PRODUCTS

### 2.01 SYSTEM DESCRIPTION

A Where more than one piping system material is specified ensure system components are compatible and joined to ensure integrity of system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

C Liquid Indicators:

1. Use line size liquid indicators in main liquid line leaving condenser.

D Valves:

1. Use service valves on suction and discharge of compressors.

E Refrigerant Charging (Packed Angle) Valve: Use in liquid line between receiver shut-off valve and expansion valve.

F Strainers:

1. Use line size strainer upstream of each automatic valve.
2. Where multiple expansion valves with integral strainers are used, use single main liquid line strainer.

G Pressure Relief Valves: Use on ASME receivers and pipe to outdoors.

H Filter-Driers:

1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.
2. Use a filter-drier on suction line just ahead of compressor.

I Solenoid Valves:

1. Use in liquid line of single or multiple evaporator systems.

### 2.02 REGULATORY REQUIREMENTS

A Comply with ASME B31.9 for installation of piping system.

B Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

C Welders Certification: In accordance with ASME BPVC-IX.

D Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

### 2.03 PIPING

A Copper Tube: ASTM B280, H58 hard drawn.

1. Fittings: ASME B16.22 wrought copper.
2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.

B Pipe Supports and Anchors:

1. Provide hangers and supports that comply with MSS SP-58.
   a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
4. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
5. Vertical Support: Steel riser clamp.
6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
7. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
8. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

### 2.04 REFRIGERANT

A Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

### 2.05 MOISTURE AND LIQUID INDICATORS

A Indicators: Single port type, UL listed, with copper or brass body, flared or soldered ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

**2.06 VALVES**

A Ball Valves:

1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F.

B Service Valves:

1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or soldered ends, for maximum pressure of 500 psi.

**2.07 STRAINERS**

A Manufacturers:

1. Hansen Technologies Corporation; _____: www.hantech.com/#sle.
2. Parker Hannifin/Refrigeration and Air Conditioning; _____: www.parker.com/#sle.
3. Sporlan, a Division of Parker Hannifin; _____: www.parker.com/#sle.

B Straight Line or Angle Line Type:

1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

**2.08 CHECK VALVES**

A Manufacturers:

1. Hansen Technologies Corporation; _____: www.hantech.com/#sle.
2. Parker Hannifin/Refrigeration and Air Conditioning; _____: www.parker.com/#sle.
3. Sporlan, a Division of Parker Hannifin; _____: www.parker.com/#sle.
4. _____.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B Straight Through Type:

1. Brass body and disc, phosphor-bronze or stainless steel spring, neoprene seat; for maximum working pressure of 500 psi and maximum temperature of 200 degrees F.

**2.09 FILTER-DRIERS**

A Performance:

1. Flow Capacity - Liquid Line: As indicated in schedule, minimum, rated in accordance with AHRI 710 (I-P) (AHRI 711 (SI)).
2. Flow Capacity - Suction Line: As indicated in schedule, minimum, rated in accordance with AHRI 730 (I-P).
3. Pressure Drop: 2 psi, maximum, when operating at full connected evaporator capacity.
4. Design Working Pressure: 350 psi, minimum.

B Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.

C Construction: UL listed.

1. Connections: As specified for applicable pipe type.

**2.10 FLEXIBLE CONNECTORS**

A Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure of 500 psi.

**2.11 EXTERIOR PENETRATION ACCESSORIES**

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

B Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A Install refrigeration specialties in accordance with manufacturer's instructions.

B Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C Install piping to conserve building space and avoid interference with use of space.

D Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

E Pipe Hangers and Supports:

1. Install in accordance with ASME B31.5.
2. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
3. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

F Provide clearance for installation of insulation and access to valves and fittings.

G Insulate piping and equipment.

H Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

**3.02 FIELD QUALITY CONTROL**

A Test refrigeration system in accordance with ASME B31.5.

B Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using halide torch. Test and repair piping until no leakage.

**END OF SECTION 23 23 00**

# SECTION 23 31 00
# HVAC DUCTS AND CASINGS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Metal ducts.

B Flexible ducts.

### 1.02 REFERENCE STANDARDS

A ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; Most Recent Edition Cited by Referring Code or Reference Standard.

B ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

D ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.

E ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

F ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023c.

G NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

H SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

I SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; 2012.

J UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

### 1.03 SUBMITTALS

A Product Data: Provide data for duct materials and duct connections.

B Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for all systems.

1. Clearly indicate which fittings shall be used on the project: elbows, wyes, takeoffs, transitions, offsets, etc.

C Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate per appropriate seal class, following SMACNA (LEAK).

### 1.04 QUALITY ASSURANCE

A Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

B Galvanizing thickness and country of origin must be clearly stenciled on each duct section. At the discretion of the Engineer, sheet metal gauges and reinforcing may be randomly checked to verify all duct construction is in compliance.

C Ductwork and fittings must have a computer generated label affixed to each section detailing the duct dimensions, sheet metal gauge, intermediate and joint reinforcement size, and the transverse connector brand and classification.

### 1.05 FIELD CONDITIONS

A Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B Maintain temperatures within acceptable range during and after installation of duct sealants.

C If ductwork is stored on site, elevate duct above floors and maintain protection on ends.

## PART 2 PRODUCTS

### 2.01 GENERAL REQUIREMENTS

A Provide ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.

B Duct Sealing and Leakage in accordance with Static Pressure Class:

1. Low Pressure Service: Up to 2 in-wc:
    a. Seal: Class C, apply to seal off transverse joints.
    b. Leakage:
        1) Rectangular: Class 16
        2) Round: Class 8

2. Medium Pressure Service: 3 in-wc
    a. Seal: Class A, apply sealing of transverse joints, longitudinal seams, and duct wall penetrations.
    b. Leakage:
        1) Rectangular: Class 8 .
        2) Round: Class 4
3. Medium Pressure Service: 4 in-wc and above
    a. Seal: Class A, apply sealing of transverse joints, longitudinal seams, and duct wall penetrations.
    b. Leakage:
        1) Rectangular: Class 4
        2) Round: Class 2

C Duct Fabrication Requirements:
1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
2. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
3. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide airfoil turning vanes of perforated metal with glass fiber insulation.
4. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
5. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
6. Provide turning vanes of perforated metal with glass fiber insulation when an acoustical lining is required.
7. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

D Duct transverse joints and reinforcement materials, including angle ring flanges and stiffeners, shall be of the same material as the duct.

E Low Pressure Supply: 2 inch w.g. pressure class, galvanized steel.

F Medium and High Pressure Supply: 4 inch w.g. pressure class, galvanized steel.

G Return and Relief: -2 inch w.g. pressure class, galvanized steel.

H General Exhaust: -2 inch w.g. pressure class, galvanized steel.

I Outside Air Intake: -2 inch w.g. pressure class, galvanized steel.

J Combustion Air: 1 inch w.g. pressure class, galvanized steel.

K Transfer Air and Sound Boots: 1 inch w.g. pressure class.

## 2.02 MATERIALS

A Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.

B Stainless Steel for Ducts: ASTM A666, Type 304.

C "Paint Grip" Finish or Mill Phosphatized Steel (Exposed Ductwork):
1. Galvanized G90 steel shall be put through a phosphate bath and have a layer of Chromate applied and dried leaving it ready to accept paint. This shall be done at the mill. The process produces a dull gray colored finish.

D Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
1. Manufacturers:
    a. Childers
    b. Ductmate
    c. Durodyne
    d. Foster
    e. Hardcast
    f. McGill Airseal

g. Sheet Metal Connectors, Inc.
h. Or Approved Equal

2. Flexible, water-based, adhesive sealant designed for use in all pressure duct systems. After curing, it shall be resistant to ultraviolet light and shall prevent the entry of water, air, and moisture into the duct system. Sealer shall be UL 723 and UL 181B-M listed and meet NFPA requirements for Class 1 ductwork. VOC shall be <75 g/l.
3. Neoprene gasket must be closed cell rubber based sealing tape and must pass UL 94 HF-1.
4. Butyl rubber gasket which complies with UL 723, Mil-C 18969B and TTS-S-001657. This material, in addition to the above, shall not contain vegetable oils, fish oils, or any other type vehicle that will support fungal and/or bacterial growth.
5. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.

E Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

F Cable Suspension System:
1. Suspension system shall be Gripple Hang-Fast as manufactured and supplied by Gripple, Inc., or Ductmate "Clutcher" cable hanging system.
2. Suspension system shall be load rated and verified by SMACNA Testing and Research Institute to be in compliance with SMACNA Standards.
3. All suspension systems shall used galvanized hardware.

**2.03 DUCTWORK FABRICATION**

A Fabricate and support in accordance with SMACNA (DCS) and as indicated.
1. Internal tie rods or bracing are not allowed for ductwork 36" and below. Tie rods shall be 1/2", 3/4", 1", 1-1/4" or 1-1/2" galvanized rods with bolt assembly consisting of rubber washer and friction anchored threaded insert similar to Ductmate Easyrod or PPI Condu-Lock.
2. Internal tie rods are not allowed for ductwork in chase and other non-accessible locations.

B Where the size for a duct segment is not indicated, the duct segment size shall be equal to the largest duct segment to which it is connected. Transition to smaller size shall occur on the side of the fitting where smaller size is indicated.

C No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE (FUND) Handbook - Fundamentals.

D Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

E Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

F Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

G Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

**2.04 HANGERS AND SUPPORTS**

A Refer to the Structural Drawngs and Details for the limitations and applications of each type of hanger and weight when attaching to bar joists, trusses, or other building Structural elements. The Contractor shall be responsible for providing additional miscellaenous steel, unistrut, and other components to span multiple joists as required by the Structural Drawings to distribute concentrated loads.

B Unless otherwise indicated, use straps or Z bar hangers with 3/8” rods to support rectangular ducts 48” wide and smaller and trapeze hangers with rods or angles to support rectangular ducts over 48” wide.
1. Use trapeze hangers to support externally insulated ductwork with weight bearing inserts.

C For round ducts 24" diameter or smaller, use single hanger.
1. Cable Suspension System may be used up to 16" diameter
2. Round Duct Strap Bracket by Ductmate Industries may be used up to 24"diameter.

D For round ducts over 24" diameter, use 2 hangers with half round trapeze.

E For round ducts over 25” diameter or larger, use 2 minimum 3/8” rods with trapeze.

F The following upper attachments, upper attachment devices, lower hanger attachments, hanger devices, and/or hanger attachments are not allowed except where specifically indicated:
1. Hook or loop.
2. Nailed pin fasteners.
3. Expansion nails without washers.
4. Powder charged or mechanically driven fasteners (forced entry anchors).
5. Beam or "C" clamps without retaining clips or friction clamps (provide retaining clips
6. for "C" clamps).
7. Friction clamps for ductwork over 12".
8. Non-factory manufactured upper attachments for metal pan deck including wire coil and double circle (Items 16 and 17 of Fig 4-3 of SMACNA HVAC Duct Construction Standards 95).
9. Wire hanger.
10. Trapeze hangers supported by wires or straps.
11. Rods, straps or welded studs directly attached to metal deck.
12. Drilled hole with attachment to structural steel.
13. Lag screw expansion anchor.
14. Rivets.

G Supporting devices shall be standard products of manufacturers having published load ratings.

H Unless drawings indicate the required framing, provide angle iron framing around roof opening where duct penetrates through roof decking, to maintain roof decking structural integrity in accordance with roof decking manufacturer's recommendations. This is not required for concrete decking. For concrete decking, consult with Structural Engineer for location and size of opening prior to execution of Work.

I For welded ducts, soldered ducts or ducts with water tight joints, do not use supports utilizing screws or other penetrations into ductwork.

J All hangers and supports shall be fully galvanized.

**2.05 METAL DUCTS**

A Material Requirements:
1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.
2. Aluminum: ASTM B209/B209M, aluminum sheet, alloy 3003-H14.

B Double Wall Insulated Round Ducts: Round spiral lockseam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with solid inner wall.
1. Manufacture in accordance with SMACNA (DCS).
2. Insulation:
   a. Thickness: 1 inch.
   b. Material: Fiberglass or elastomeric foam.
   c. Finish: "Paint grip" mill phosphatized
3. Manufacturers:
   a. MKT Metal Manufacturing
   b. Hamlin
   c. SMC
   d. McGill Airflow
   e. Or Approved Equal

C Double Wall Insulated Rectangular Ducts: Rectangular spiral lockseam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with solid inner wall.
1. Manufacture in accordance with SMACNA (DCS).
2. Insulation:
   a. Thickness: 1 inch.
   b. Material: Fiberglass or elastomeric foam.
   c. Finish: "Paint grip" mill phosphatized

D Spiral Ducts: Round spiral lockseam duct with galvanized steel outer wall.

1. Manufacture in accordance with SMACNA (DCS).
2. Manufacturers:
    a. EHG, a DMI Company
    b. GSI, a DMI Company
    c. Linx Industries, Inc, a DMI Company
    d. MKT Metal Manufacturing
    e. Or Approved Equal

**2.06 FLEXIBLE DUCTS**

A Flexible Air Ducts:
1. UL 181, Class 0, interlocking spiral of aluminum foil.
2. Insulation: Fiberglass insulation with aluminized vapor barrier film.
3. Pressure Rating: 8 in-wc positive or negative.
4. Maximum Velocity: 5,000 fpm.
5. Temperature Range: Minus 20 to 250 degrees F.

**2.07 LONGITUDINAL SEAM:**

A Rectangular Duct:
1. Unless otherwise indicated, use Pittsburgh lock seam construction.
2. Seal longitudinal seams with approved sealant or provide pre-sealed from factory with encapsulated mastic.
3. Button punch snap lock construction (SMACNA L-2) is not allowed except for ductwork that is both low pressure (2” WG or lower pressure class) and 18” and smaller duct width.
4. Button punch snap lock construction is not allowed for ductwork in chases and areas above inaccessible ceilings.
5. Button punch snaplock construction is not allowed on exhaust ductwork or aluminum ductwork

B Round and Oval Duct
1. Unless otherwise indicated, longitudinal seams shall be in accordance with SMACNA HVAC Duct Construction Standards with the following exceptions:
    a. Snaplock seams are not allowed.
    b. SMACNA seam types RL-3, 6A, 6B, 7, and 8 shown in Figure 3-2 are not allowed, except for 2" w.g. class round ducts 16" or less in diameter.

**2.08 RECTANGULAR TRANSVERSE JOINT CONNECTORS:**

A Slide-on Transverse Joint Connectors:
1. Duct constructed using engineered slide-on connector systems must be submitted and conform to manufacturer’s published duct construction standards and guidelines for joint classification, sheet metal gauge, intermediate and joint reinforcement size and spacing, unless otherwise specified.
2. Manufacturer of engineered connector system must have certified independent performance testing for leakage, deflection and seismic stability.
3. All components of the engineered system must be clearly embossed with the manufacturer’s name, model number or identifying marking.
4. Butyl rubber gasket must be applied per the manufacturer’s instructions on all connections except for breakaway connections. Closed Cell Neoprene gasket must be applied per the manufacturer’s instructions on all breakaway connections. No substitution of connector system components or gaskets is permitted.
5. All duct installed using engineered connectors must adhere to the manufacturer’s published assembly and installation guidelines for all standard, breakaway, roof-top or specialty connections unless otherwise specified.

B Formed-on Flanges:
1. Lockformers TDC or Engles TDF may be used in accordance with T-25 flanges of SMACNA HVAC Duct Construction Standards, provided that corner pieces with bolts are used. If TDF/TDC flanges are damaged, replace the damaged joint(s) by straightening and reinforcing with minimum 1-1/2 x 1-1/2 x 1/4 angle at each side of transverse joint

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A Install, support, and seal ducts in accordance with SMACNA (DCS).

B During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

C Install ductwork parallel to building walls and ceilings and at such heights not to obstruct any portion of window, doorway, stairway, or passageway. Install ductwork to allow adequate access and service space for equipment and access clearances for cable tray/j-hooks. Refer to drawings and/or manufacturer's recommendations Install vertical ductwork plumb. Make allowances for beams, pipes or other obstructions in building construction and for work of other contractors. Check plans showing work of other trades and consult with Engineer in event of any interference.

D Where interferences develop in the field, offset or reroute ductwork as required to clear such interferences. Do not divide duct and do not route any other utilities such as piping or conduit through duct. In all cases, consult drawings for exact location of space allocated for duct, ceiling heights, door and window openings, or other architectural details before fabricating or installing duct. Consult Designer where conflicts arise between ductwork and other utilities which cannot be resolved by relocating duct.

E Where offsets in ductwork are required, contractor to use standard 30, 45 or 90-degree elbows. Where space constraints do not allow for the use of standard elbows for offsets, use of angled offsets as depicted by SMACNA Figure 2-7 (Angled Offset Type 1) may be used with maximum angle of offset not to exceed 15 degrees maximum. Offsets Type 2 and 3 in SMACNA Figure 2-7 shall not be allowed.

F Rectangular Duct Elbows:

1. Rectangular Duct: Unless specific type is indicated, provide radius elbows with splitter vanes with minimum centerline radius to width or diameter ratio of 1.5
    a. 1.5 radius elbows with full spliter vanes as follows:
        1) One vane for duct width 2-12"
        2) Two vanes for duct width 13-20"
        3) Three vanes for duct width 21"-36"
        4) Four vanes for duct width 38" and larger
        5) Fabricate vanes in accordance with SMACNA.
    b. Rectangular throad elbows with turning vanes where 1.5 radius elbows do not fit.
    c. Rectangular throat/radius heel elbows or rectangular elbows without turning vanes shall not be used.

G Round and Oval Duct Elbows:

1. Unless specific type is indicated, use radius elbows with centerline radius to diameter ratio of 1.5. ONLY where1.5 radius elbows do not fit, 1.0 radius elbows may be used if approved by the Engineer.

H Construct ductwork so that interior surfaces are smooth. Internal duct hangers and internal bracing are not allowed. Refer to above for internal tie rods.

I Support coils, filters, air terminals, dampers, sound attenuating devices, or other devices installed in duct systems with angles or channels and make all connections to such equipment including equipment furnished by others. Secure frames with gaskets, nuts, bolts and washers.

J Flexible ducts shall not exceed 5 feet in length. Bends, kinks, and sagging of flexible duct will not be accepted. The maximum permitted sag is 1/2" per foot of support spacing.

K Install outside air intake duct to pitch down at minimum 1” per 20 ft toward intake louver or plenum and to drain to outside of building. Solder or seal seams to form watertight joints.

L Install exhaust air duct to pitch down at minimum 1” per 20 ft toward exhaust louver.

M Where 2 different metal ducts meet, install joint in such a manner that metal ducts do not contact each other by using proper gasket seal or compound.

N Flexible Ducts: Connect to metal ducts with adhesive plus sheet metal screws.

1. Flexible ducts are not allowed for special exhaust systems, such as laboratory exhaust, vehicle exhaust, etc.
2. Splicing of flexible duct will not be allowed.
3. Flexible ducts shall not pass through any partition, wall, floor, or ceiling.

O Residential Clothes Dryer Exhaust Duct: Provide stenciled label. Label shall indicate the following:
1. Equivalent length ------ feet. Any installed dryer must be equipped with an exhaust system that meets or exceeds this equivalent length requirement.

P All ducts conveying hazardous or flammable vapors shall be labeled via stencilled painting or permanent nameplates. Labels shall be every 10 feet where above accessible ceilings or in mechanical rooms or on roof.

Q Duct sizes indicated are precise inside dimensions. For lined ducts, maintain sizes inside lining.

R Provide openings in ductwork as indicated to accommodate thermometers and controllers. Provide pilot tube openings as indicated for testing of systems, complete with metal can with spring device or screw to insure against air leakage. For openings, insulate ductwork and install insulation material inside a metal ring.

S Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

T All exposed ductwork to be painted shall be mill bonderized or "paint grip." The contractor shall thoroughly clean all ductwork surfaces to be free from oils, grease, lubricants, and other contaminants prior to application of paint. Follow

U 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.

V Use double nuts and lock washers on threaded rod supports.

W Connect terminal units to supply ducts with hard duct. Maintain minimum three (3) feet or three (3) duct diameters (whichever is greater) of straight duct prior to inlet of box. Connecting flex duct to the inlets of terminal units will NOT be acceptable.

X Provide minimum 5 ft of straight duct on outlet side of VAV boxes before first tap.

Y At exterior wall louvers, seal duct to louver frame and install blank-out panels.

Z All trapeze hanger rods shall be cut to within 1" of the bottom nut.

**3.02 DUCT LEAKAGE TESTING**

A All transverse joints and longitudinal seams shall conform to SMACNA’s Class A sealing requirements as defined in the SMACNA Manual.

B Ductwork Sealing: As a minimum standard, ductwork and plenums shall be sealed in accordance with Table 6.2.4.3A of ASHRAE Standard 90.1 (as required to meet the requirements of Section 6.2.4.4 SMACNA Duct Leakage Test Procedures).

C Prove tightness of duct construction by operating air handling equipment and physically verifying absence of any air leakage, both audibly and manually. Repair as needed to achieve minimal leakage. Examine every joint and verify leak tight. If further testing is needed to resolve duct leakage problems, particularly as related to sound criteria, comply with procedure outline in 1985 (or current edition) of SMACNA HVAC Air Duct Leakage Test Manual.

D Ductwork constructed to 3" w.g. pressure class (positive or negative) or higher shall be leak-tested according to the SMACNA HVAC Air Leakage Test Manual. All sections shall be tested, unless otherwise noted.

E The Test Pressure for each system shall be equal to the construction pressure class the respective duct system is constructed to.

F Maximum permitted duct leakage shall be:
1. Lmax = CL x Test Pressure “P” raised to the 0.65 power where Lmax is maximum permitted leakage in CFM/100 sq. ft. duct surface area
   a. CL is duct leakage class
   b. P is test pressure, equal to the duct construction pressure class in inches w.c.

G Duct Air Leakage Testing (DALT):
1. Installed ductwork shall be tested prior to installation of access doors, take-offs etc.
2. All testing shall be witnessed by the engineer or owner’s representative. Contractor shall give the engineer or owner’s representative 72 hours’ notice prior to testing.
3. The testing shall be performed as follows:
   a. Perform testing in accordance with SMACNA HVAC Air Duct Leakage Test Manual.
   b. Use a certified orifice tube for measuring the leakage.
   c. Define section of system to be tested and blank off.
   d. Determine the percentage of the system being tested.
   e. Using that percentage, determine the allowable leakage (CFM) for that section being used.

f. Pressurize to operating pressure and repair any significant or audible leaks.
g. Re-pressurize and measure leakage.
h. Repeat steps 6 and 7 until the leakage is less than the allowable defined in step 5.

**END OF SECTION 23 31 00**

# SECTION 23 33 00
# AIR DUCT ACCESSORIES

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Backdraft dampers - metal.
B Combination fire and smoke dampers.
C Duct access doors.
D Duct test holes.
E Fire dampers.
F Flexible duct connectors.
G Volume control dampers.
H Miscellaneous products:
1. Internal strut end plugs.
2. Duct opening closure film.

### 1.02 REFERENCE STANDARDS

A NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
B NFPA 92 - Standard for Smoke Control Systems; 2021, with Amendment.
C NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.
D SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.
E UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.
F UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.
G UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

### 1.03 SUBMITTALS

A Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.
B Manufacturer's Installation Instructions: Provide instructions for fire dampers and combination fire and smoke dampers.
C Project Record Drawings: Record actual locations of access doors and test holes.
D Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Extra Fusible Links: One of each type and size.

### 1.04 QUALITY ASSURANCE

A Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum five years of documented experience.
B Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
C All dampers shall be certified to bear the AMCA Certified Ratings Program seal for Air Performance, Efficiency, and Air Leakage.

### 1.05 DELIVERY, STORAGE, AND HANDLING

A Protect dampers from damage to operating linkages and blades.
B Storage: Store materials in a dry area indoor, protected from physical damage and in accordance with manufacturer's instructions.

## PART 2 PRODUCTS

### 2.01 AIR TURNING DEVICES/EXTRACTORS

A Manufacturers:
1. Carlisle HVAC Products
2. Elgen Manufacturing, Inc
3. Ruskin Company
4. Titus HVAC, a brand of Johnson Controls
5. Ward Industries, a brand of Hart and Cooley, Inc
6. Or Approved Equal
B Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

**2.02 BACKDRAFT DAMPERS - METAL**

A Manufacturers:
1. Nailor Industries, Inc
2. Ruskin Company, a brand of Johnson Controls
3. United Enertech
4. Greenheck
5. Arrow
6. Or Approved Equal

B Frames shall be flanged, a minimum of 3 inches wide, and a minimum of 20 gauge roll formed galvanized steel or 0.125 inch extruded aluminum with pre-punched mounting holes and welded corner clips for maximum rigidity.

C Blades shall be single piece, with a maximum width of 6 inches, counter balanced, and shall be constructed of minimum 26 gauge rool formed galvanized steel or 0.070 inch extruded aluminum. Blade ends shall overlap for maximum weather protection.

D Blade seals shall be extruded vinyl and mechanically attached to blade edge.

E Bearings shall be corrosion resistant synthetic.

F Linkages shall use a galvanized tie bar with stainless steel pivot pins.

G Axles shall be stainless steel.

H Mounting shall be suitable for the required orientation.

**2.03 DUCT AIR TURNING VANES**

A Provide factory manufactured turning vanes in each elbow where inside radius is less than the width of the duct, and in all square or rectangular elbows.

B Turning vane assemblies shall be adequately supported and affixed to prevent rattling, breakaway, and shall not deform. Assemblies longer than 12 inches shall be double wall.

C Turning vanes in negative pressure ductwork with pressure rating above 2 inches shall be installed in accordance with SMACNA Industrial Duct Construction Standard.

D Turning vanes shall match the duct material construction.

E Rectangular Throat Elbow Truning Vanes (Vane Runner Length up to 18" and Vane Length up to 36")
1. Provide single blade type vanes having 2" radius and 1-1/2" spacing, 24 gauge minimum. Construct vanes in accordance with SMACNA HVAC Duct Construction Standards.
2. If duct size changes in mitered elbow, use single blade type vanes with trailing edge extension.

F Rectangular Throat Elbow Truning Vanes (Vane Runner Length up to 18" and Vane Length up to 36"):
1. Use double wall airfoil type with smoothly-rounded entry nose and extended trailing edge on 2.4" center spacing.
2. Vanes shall be equal to HEP (High Efficiency Profile) vanes as manufactured by Aero/Dyne Co.

G Radius Elbow Splitter Vanes:
1. Splitter vanes for radius elbows shall be extended entire length of fitting and constructed in accordance with SMACNA HVAC Duct Construction Standards.

H Manufacturers:
1. Aero Dyne
2. Ductmate, Inc.
3. Sheet Metal Connectors, Inc.
4. Duro-Dyne
5. DynAir Inc.
6. Or Approved Equal

**2.04 WIRE MESH SCREENS**

A Screen assemblies shall be removable.

B Mesh: 1/2 inch square pattern, 1/16 inch galvanized wire, interwoven, welded at wire intersections and to the frame to prevent rattles.

C Frames: Minimum of 1 inch by 1 inch by 1/8 inch galvanized steel angles for duct sizes through 24 inches, 1-1/2 inch by 1-1/2 inch by 3/16 inch for duct sizes between 25 inches and 48 inches, and 2 inches by 2 inches for ducts larger than 48 inches continuous around perimeter of screen. Provide intermediate supports

to limit screen deflection to 1/16 inch at maximum design airflow.

**2.05 COMBINATION FIRE AND SMOKE DAMPERS**

A Manufacturers:
1. Air Balance/ABI
2. Nailor Industries, Inc
3. NCA, a brand of Metal Industries Inc
4. Pottorff
5. Ruskin Company, a brand of Johnson Controls
6. United Enertech
7. Metal Industries
8. ATI Industries
9. Or Approved Equal

B Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.

C Provide factory sleeve and collar for each damper. Minimum 20 gauge thickness. Silicon caulk factory applied to sleeve at damper frame to comply with leakage rating requirements.

D UL 555S Leakage Rating: Class 1 (8 CFM at 4 in. w.g. differential pressure)

E Maximum Velocity: 4000 fpm

F Maximum Pressure: 8 in w.g.

G Maximum Pressure Drop: The maximum allowable pressure drop across the damper shall not exceed 0.15 in w.g. at 2000 FPM.

H Frame: 5 inches x minimum 16 gage roll formed, galvanized steel hat-shaped channel, reinforced at corners. Structurally equivalent to 13 gage (2.3 mm) U-channel type frame.
1. Provide single section construction for duct sizes up to 48x30. Section shall be equivalent to duct opening indicated on Drawings.

I Blades:
1. Style: True airfoil-shaped, single piece, double skin.
2. Action: Opposed.
3. Material: Minimum 14 gage equivalent thickness, galvanized steel.
4. Width: Maximum 6 inches.
5. Orientation: Vertical or Horizontal

J Bearings: Self-lubricating stainless steel sleeve, turning in extruded hole in frame.

K Seals:
1. Inflatable silicone fiberglass material to maintain smoke leakage rating to a minimum of 450 degrees F and galvanized steel for flame seal to 1,900 degress F. Mechanically attached to blade edge (glue-on or grip type seals are not acceptable).
2. Jamb: Stainless steel, flexible metal compression type.

L Linkage: Concealed in frame.

M Axles: Minimum ½ inch diameter plated steel, hex-shaped, mechanically attached to blade.

N Mounting: Vertical and/or Horizontal.

O Operators: UL listed and labelled spring return electric type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on exterior of duct and link to damper operating shaft.

P Normally Closed Smoke Responsive Fire Dampers: Curtain type, opening by gravity upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure.

Q Provide damper test switch accessory for cycle testing.

R Provide optional auxiliary switch package to allow remote indication of damper blade position.

S Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.

**2.06 FLEXIBLE DUCT 90° ELBOW SUPPORT**

A Manufacturers:
1. Build Right Products
2. Hart and Cooley

3. Thermaflex
4. Or Approved Equal

B Pre-manufactured support to form any brand flexible duct into a smooth 90 degree elbow.
1. One size shall fit 4" to 16" flexible ducts
2. No additional tools shall be required for installation
3. UL listed for use in Return Air Plenums

**2.07 DUCT ACCESS DOORS**

A Manufacturers:
1. Acudor Products Inc, a Division of Nelson Industrial Inc
2. Ductmate Industries, Inc, a DMI Company
3. Durodyne
4. Elgen Manufacturing
5. MKT Metal Manufacturing
6. Nailor Industries Inc
7. Ruskin Company
8. SEMCO LLC
9. Or Approved Equal

B Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.
1. Up to 18 inches Square: Provide two hinges and two sash locks.
2. Up to 24 by 48 inches: Three hinges and two compression latches with outside and inside handles.

C Access doors with sheet metal screw fasteners are not acceptable.

D Provide access doors of adequate size to allow easy access to the equipment that will require maintenance. Provide insulated or acoustically lined doors to prevent condensation where applicable.

E Manufacturer shall provide a neoprene gasket around perimeter of access door for airtight seal.

F Systems 2" w.g. or less shall use a hinged, cam, or hinged & cam square framed access door.

G Systems 3" w.g. and above shall use a sandwich type access door. Construct doors in accordance with Figure 7-3 of the 2005 SMACNA Manual, "HVAC Duct Construction Standards, Metal & Flexible," Third Edition. Doors shall be rated for +/- 10" w.g.

**2.08 DUCT TEST HOLES**

A Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

**2.09 FIRE DAMPERS**

A Manufacturers:
1. Nailor Industries Inc
2. NCA, a brand of Metal Industries Inc
3. Pottorff
4. Ruskin Company
5. United Enertech
6. Air Balance/ABI
7. Greenheck
8. Metal Industries
9. Prefco
10. ATI Industries
11. Or Approved Equal

B Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

C Fire Resistance: 1-1/2 hours or 3 hours as required by assembly rating.

D Dynamic Closure Rating: Dampers shall be classified for dynamic closure to 4000 fpm and 4 inches w.g. static pressure.

E Construction:

1. Integral Sleeve Frame: Minimum 20 gauge roll formed galvanized steel. Sleeve length to be determined by Contractor for each condition.
2. Blades:
   a. Curtain type
   b. Action: Spring or gravity closure upon fusible link release.
   c. Orientation: Horizontal.
   d. Material: Minimum 24 gage roll formed, galvanized steel.
3. Closure Springs: Type 301 stainless steel, constant force type, if required.
4. Mounting: Vertical and/or Horizontal.
5. Duct Transition Connection, Damper Style:
   a. B style – rectangular connection, blades out of air stream, high free area.
   b. G style – A style connection, grille mounting tabs at end of sleeve for grille.
   c. CR style – round connection, sealed.
6. Finish: Mill galvanized.

F Fusible Links: UL 33, separate at 165 degrees F with adjustable link straps for combination fire/balancing dampers.

G Breakaway Connection:
1. Ductmate or Drivemate.

**2.10 FLEXIBLE DUCT CONNECTORS**

A Manufacturers:
1. Carlisle HVAC Products
2. Ductmate Industries, Inc, a DMI Company
3. Elgen Manufacturing, Inc
4. Durodyne
5. Or Approved Equal

B Flexible duct connector shall be used where ductwork connects to fan apparatus or fan casings to isolate vibration transfer. Connectors shall be attached in such a manner as to provide an airtight and waterproof seal.

C Connectors will comply with NFPA 90A, “Installation of Air Conditioning & Ventilation Systems” and NFPA 90B, “Installation of Warm Air Heating & Air Conditioning Systems”.

D Connector fabrics shall meet NFPA 701 (formerly UL 214.)

E Connector fabrics shall be mildew resistant per ASTM G21.

F Indoor installations shall be NFPA 701 listed, fire retardant Vinyl coated woven nylon or Neoprene coated woven fiberglass fabric. Minimum density of Vinyl is 20 oz. /sq. yd. and rated to 200F. Minimum density of Neoprene 30 oz. / sq. yard and rated to 200F.

G Outdoor installations shall be NFPA 701 listed UV-resistant Hypalon coated woven fiberglass fabric. Minimum density 24 oz. /sq. yd. and rated to 250F.

H High temperature applications shall be NFPA 701 listed, Silicone coated satin weave fiberglass fabric. Minimum density 17.5 oz. /sq. yd. and rated to 500 F.

I Chemical resistant applications shall be of Teflon coated woven fiberglass fabric. Minimum density 18 oz. /sq. yd. and rated to 500 F.

J Fabricate in accordance with SMACNA (DCS) and as indicated.

K Flexible Duct Connections: Fabric crimped into metal edging strip.

**2.11 VOLUME CONTROL DAMPERS**

A Manufacturers:
1. MKT Metal Manufacturing
2. Nailor Industries Inc
3. NCA, a brand of Metal Industries Inc
4. Ruskin Company:
5. United Enertech
6. Greenheck
7. Pottorff

8. Johnson Controls
9. Air Balance, Inc.
10. Or Approved Equal

B Fabricate in accordance with SMACNA (DCS) and as indicated.

C Round Control Damper - 1 in w.g. and below:
1. Velocity: Up to 2,000 fpm
2. Temperature: 180°F
3. Construction:
   a. Frame Material - Galvanized Steel
   b. Frame Thickness: 20 gauge
   c. Blade Material: Galvanized Steel
   d. Axle Bearings: Bronze
   e. Axle Material: Plated Steel
   f. Operaror: 3/8 inch sq. locking manual quandrant.
      1) On insulated ducts, provide 2 inch standoff bracket
   g. Manufacturers:
      1) Greenheck MBDR-50
      2) Ruskin
      3) Nailor

D Round Control Damper - 4 in w.g. and below:
1. Velocity: Up to 3,000 fpm
2. Temperature: 180°F
3. Leakage: 4 cfm/ft2 @ 1 in. wg
4. Construction:
   a. Frame Material - Galvanized Steel
   b. Frame Thickness: 20 gauge
   c. Blade Material: Galvanized Steel
   d. Blade seal: Silicone
   e. Axle Bearings: Bronze
   f. Axle Material: Plated Steel
   g. Operaror: 3/8 inch sq. locking manual quandrant.
      1) On insulated ducts, provide 2 inch standoff bracket
5. Manufacturers:
   a. Greenheck VCDR-53
   b. Ruskin
   c. Nailor

E Rectangular Single Blade Dampers: 1 in w.g. and below, up to 10 x 30 inch duct
1. Velocity: Up to 2,000 fpm
2. Temperature: 180°F
3. Construction:
   a. Frame Material - Galvanized Steel
   b. Frame Thickness: 20 gauge
   c. Blade Material: Galvanized Steel
   d. Axle Bearings: Synthetic sleeve type
   e. Axle Material: Plated Steel
   f. Operaror: 3/8 inch sq. locking manual quandrant, 2-1/2 inch long extension
      1) On insulated ducts, provide 2 inch standoff bracket
4. Manufacturers:
   a. Greenheck MBD-10M
   b. Ruskin
   c. Nailor

F Rectangular Multi-Blade Balancing Dampers: 2 in w.g. and below

1. Pressure: Up to 4 in w.g.
2. Velocity: 2,000 fpm
3. Temperature: 180°F
4. Construction:
    a. Frame Material - Galvanized Steel
    b. Frame Thickness: 16 gauge
    c. Blade Material: Galvanized Steel
    d. Blade Thickness: 16 gauge
    e. Blade Type: 3V
    f. Blade Operation: Opposed
    g. Axle Bearings: Synthetic sleeve type
    h. Axle Material: Plated Steel
    i. Operaror: 1/2 inch locking manual quandrant, 1-1/2 inch long standoff bracket
    j. Extension Pin: 1/2 inch diagonal glass reinforced polymer extends 3-1/2 inch beyond frame
5. Manufacturers:
    a. Greenheck MBD-15
    b. Ruskin
    c. Nailor

G Quadrants:
1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
3. Where rod lengths exceed 30 inches provide regulator at both ends.

**2.12 MISCELLANEOUS PRODUCTS**

A Internal Strut End Plugs: Combination end-mounting and sealing plugs for metal conduit used as internal reinforcement struts for metal ducts; plug crimped inside conduit with outside gasketed washer seal.

B Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.
1. Thickness: 2 mils.
2. High tack water based adhesive.
3. UV stable light blue color.
4. Elongation Before Break: 325 percent, minimum.
5. Manufacturers:
    a. Carlisle HVAC Products; Dynair Duct Protection Film
    b. Surface Shields
    c. Trimaco
    d. Ductmate ProGuard
    e. Or Approved Equal

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 31 00 for duct construction and pressure class.

B Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C Provide a pre-manufactured support at each diffuser to turn the flex duct into a 90° elbow.

D Contractor shall identify balancing dampers above the ceiling by either spray painting them bright orange or hanging an orange flag from the damper handle. If hanging a flag in a return air plenum, material shall comply with fire and smoke spread ratings for plenum use.

E All fire dampers, smoke dampers, and combination fire/smoke dampers shall be installed with bottom edge 24" maximum above lay-in ceiling.

F All balancing dampers shall be installed maximum 30" above the lay-in ceiling.

G Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 12 by 12 inch size for hand access, size for shoulder access, and as indicated. Provide 8 by 8 inch for balancing

dampers only. Review locations prior to fabrication.

H Provide duct test holes where indicated and required for testing and balancing purposes.

I Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

J Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.

K The Contractor shall inspect and test all fire dampers, smoke dampers, and combination fire/smoke dampers in accordance with NFPA 80 in the presence of the Authority Having Jurisdiction.

L Demonstrate re-setting of fire dampers to Owner's representative.

M At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

N At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

1. Refer to Section 23 05 48.

O Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

P Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

**END OF SECTION 23 33 00**

# SECTION 23 34 23
# HVAC POWER VENTILATORS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Roof exhausters.

B Cabinet exhaust fans.

### 1.02 RELATED REQUIREMENTS

A Section 23 05 13 - Common Motor Requirements for HVAC Equipment.

B Section 23 05 48 - Vibration and Seismic Controls for HVAC.

C Section 23 31 00 - HVAC Ducts and Casings.

D Section 23 33 00 - Air Duct Accessories: Backdraft dampers.

### 1.03 REFERENCE STANDARDS

A AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.

B AMCA 99 - Standards Handbook; 2016.

C AMCA 204 - Balance Quality and Vibration Levels for Fans; 2020.

D AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016, with Errata (2018).

E AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.

F AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2022.

### 1.04 SUBMITTALS

A See Section 01 30 00 - Administrative Requirements for submittal procedures.

B Product Data: Provide data on fans and accessories, including fan curves with specified operating point plotted, power, rpm, sound power levels at rated capacity, and electrical characteristics and connection requirements.

C Manufacturer's Instructions: Indicate installation instructions.

D Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

E Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Extra Fan Belts: One set for each individual fan.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A Carnes, a division of Carnes Company Inc; _____: www.carnes.com/#sle.

B Greenheck Fan Corporation; _____: www.greenheck.com/#sle.

C Loren Cook Company; _____: www.lorencook.com/#sle.

### 2.02 POWER VENTILATORS - GENERAL

A Static and Dynamically Balanced: Comply with AMCA 204.

B Performance Ratings: Comply with AMCA 210, bearing certified rating seal.

C Sound Ratings: Comply with AMCA 301, tested to AMCA 300, bearing certified sound ratings seal.

D Fabrication: Comply with AMCA 99.

E Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

### 2.03 ROOF EXHAUSTERS

A Manufacturers:

1. Carnes, a division of Carnes Company Inc; VEBK, VEDK: www.carnes.com/#sle.
2. Greenheck Fan Corporation; G , GB: www.greenheck.com/#sle.

B Basis of Design: Greenheck Fan Corporation; www.greenheck.com

1. Belt Drive, Down-Blast Discharge: G.
2. Direct Drive, Down-Blast Discharge: GB

C Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb

gaskets.

D Roof Curb: 8 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips.

E Disconnect Switch: Factory wired, nonfusible, in housing for thermal overload protected motor.

F Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked.

G Performance Ratings: As indicated on drawings.

**2.04 CABINET EXHAUST FANS**

A Manufacturers:

1. Carnes, a division of Carnes Company Inc; VCDD: www.carnes.com/#sle.
2. Greenheck Fan Corporation; SP: www.greenheck.com/#sle.

B Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resiliently mounted motor, gravity backdraft damper in discharge.

C Disconnect Switch: Cord and plug-in housing for thermal overload protected motor and unit mounted speed controller.

D Grille: Molded white plastic.

E Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is reached with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

F Performance Ratings: As indicated on drawings.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A Install in accordance with manufacturer's instructions.

B Secure roof exhausters with cadmium plated steel lag screws to roof curb.

C Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.

D Hung Cabinet Fans:

1. Install fans with resilient mountings and flexible electrical leads, see Section 23 05 48.
2. Install flexible connections between fan and ductwork; see Section 23 33 00. Ensure metal bands of connectors are parallel with minimum 1 inch flex between ductwork and fan while running.

**END OF SECTION 23 34 23**

# SECTION 23 37 00
# AIR OUTLETS AND INLETS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Diffusers:

B Rectangular ceiling diffusers.

C Registers/grilles:

1. Ceiling-mounted, exhaust and return register/grilles.
2. Ceiling-mounted, supply register/grilles.
3. Wall-mounted, supply register/grilles.
4. Wall-mounted, exhaust and return register/grilles.

D Fabric air distribution devices.

E Louvers:

### 1.02 RELATED REQUIREMENTS

A Section 09 91 23 - Interior Painting: Painting of ducts visible behind outlets and inlets.

### 1.03 REFERENCE STANDARDS

A AMCA 550 - Test Method for High Velocity Wind Driven Rain Resistant Louvers; 2022.

B ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023c.

C NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

D NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

E UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

F UL 2518 - Standard for Safety Air Dispersion Systems; Current Edition, Including All Revisions.

### 1.04 SUBMITTALS

A See Section 01 30 00 - Administrative Requirements for submittal procedures.

B Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

C Project Record Documents: Record actual locations of air outlets and inlets.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A Carnes, a division of Carnes Company Inc: www.carnes.com/#sle.

B Krueger-HVAC: www.krueger-hvac.com/#sle.

C Price Industries: www.price-hvac.com/#sle.

D Ruskin Company: www.ruskin.com/#sle.

E Titus, a brand of Air Distribution Technologies: www.titus-hvac.com/#sle.

### 2.02 RECTANGULAR CEILING DIFFUSERS - TYPE MARY ON SCHEDDULE - A,B,C AND D

A Manufacturers:

1. Krueger-HVAC; 1400: www.krueger-hvac.com/#sle.
2. Price Industries Inc; SCD: www.price-hvac.com/#sle.

B Type: Provide rectangular and square formed adjustable, backpan stamped, core removable, and multi-louvered ceiling diffusers constructed to maintain 360 degree discharge air pattern with sectorizing baffles where indicated.

C Frame: Provide surface mount, snap-in, inverted T-bar, and spline type. In plaster ceilings, provide plaster frame and ceiling frame.

D Fabrication: Steel with baked enamel finish.

E Color: White.

F Accessories: Provide opposed blade volume control damper; equalizing grid and gaskets for surface mounted diffusers with damper adjustable from diffuser face.

### 2.03 CEILING SUPPLY REGISTERS/GRILLES

A Manufacturers:

1. Krueger-HVAC; 880: www.krueger-hvac.com/#sle.

2. Price Industries Industries; 540: www.price-hvac.com/#sle.

B Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, two-way deflection.

C Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

D Construction: Made of steel with factory enamel finish.

E Construction: Made of steel.

F Color: white.

**2.04 CEILING EXHAUST AND RETURN REGISTERS/GRILLES**

A Manufacturers:

1. Krueger-HVAC; 80: www.krueger-hvac.com/#sle.
2. Price Industries; 530

B Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees, vertical face.

C Frame: 1-1/4 inch margin with countersunk screw mounting.

D Fabrication: Steel with 20 gauge, 0.0359 inch minimum frames and 22 gauge, 0.0299 inch minimum blades, steel and aluminum with 20 gauge, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.

E Color: white.

**2.05 HEAVY DUTY SUPPLY REGISTERS/GRILLES**

A Schedule Type Mark **E** Supply : Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, vertical face, double deflection.

B Schedule Type Mark **7** - Return: Streamlined and individually adjustable curved blades to discharge air along face of grille with one-way deflection.

C Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

D Fabrication: Steel with 14 ga steel minimum frames and 18 gauge minimum blades, with factory baked enamel finish.

E Color: To be selected by Architect from manufacturer's standard range.

F Gymnasiums: Provide front pivoted or welded in place blades, securely fastened to be immobile.

G General Requirements:

1. Diffuser material to comply with ASTM E84, UL 723, UL 2518, NFPA 90A, and NFPA 90B.
2. Air Dispersion Method:
3. Hanger Supports:

**2.06 LOUVERS**

A Manufacturers:

1. Ruskin Company; HZ700MD: www.ruskin.com/#sle. AMCA540/550 Extreme Performace and AMCA 500-L wind driven rain Miami-Dade listed louver.

B Type: Double frane 4 inch deep front frame and 3 inch deep rear framefor combined frame depth of 7 inches, with horizontal front blade on a 3.8 inch center to center spacing and vertical rear blade on a 3/4 inc center to center spacing.,1/2 inch square mesh screen over exhaust end.

C Fabrication: 6063T6 extruded aluminum with .080" and .050" nominal wall thickness thick galvanized aluminum welded assembly, with factory prime coat finish.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A Install in accordance with manufacturer's instructions.

B Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

C Install diffusers to ductwork with air tight connection.

D Provide balancing dampers on duct take-off to diffusers and grilles and registers, despite whether dampers are specified as part of diffuser, or grille and register assembly.

E Paint ductwork visible behind air outlets and inlets matte black, see Section 09 91 23.

**3.02 PROTECTION**

A Protect installed products until completion of project.

B Replace, repair, or touch-up damaged products before Substantial Completion.

**END OF SECTION 23 37 00**

**SECTION 23 74 00**
**HIGH PERCENTAGE OUTSIDE AIR PACKAGED DX UNIT**

## PART 1 GENERAL

### 1.01 GENERAL DESCRIPTION

A This section includes the design, controls and installation requirements for packaged rooftop units / outdoor air handling units.

### 1.02 REFERENCE STANDARDS

A AHRI Standard 920 (I-P) 2015 - Standard for Performance Rating of DX - Dedicated Outdoor Air System Units

### 1.03 QUALITY ASSURANCE

A Packaged air-cooled condenser units shall be certified in accordance with ANSI/AHRI Standard 340/360 performance rating of commercial and industrial unitary air-conditioning and heat pump equipment.

B Packaged air-cooled condenser units shall be certified in accordance with AHRI Standard 920 performance rating of DX Dedicated Outdoor Air System Units.

C Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.

D Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.

E Unit Energy Efficiency Ratio (EER) shall be equal to or greater that prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.

F Unit shall be safety certified by ETL and ETL US listed. Unit nameplate shall include the ETL/ETL Canada label.

### 1.04 SUBMITTALS

A Product Data: Literature shall be provided that indicates dimensions, operating and shipping weights, capacities, ratings, fan performance, filter information, factory supplied accessories, electrical characteristics and connection requirements. Installation, Operation, and Maintenance manual with startup requirements shall be provided.

B Shop Drawings: Unit drawings shall be provided that indicate assembly, unit dimensions, construction details, clearances and connection details. Computer generated fan curves for each fan shall be submitted with specific design operation point noted. Wiring diagram shall be provided with details for both power and control systems and differentiate between factory installed and field installed wiring.

### 1.05 COORDINATION

A If equipment is supplied by a manufacturer other than the one named, coordinate with the General Contractor and affected subcontractors to ensure the specified performance is met. This coordination shall include (but is not limited to) the following:

1. Structural supports for units.
2. Size and location of concrete bases/housekeeping pads
3. Location of roof curbs, unit supports and roof penetrations
4. Ductwork sizes and connection locations
5. Piping size and connection/header locations
6. Interference with existing or planned ductwork, piping and wiring
7. Electrical power requirements and wire/conduit and over current protection sizes.
8. Trap height requirements

B The Mechanical Contractor shall be responsible for costs incurred by the General Contractor, Subcontractors, and Consulting Engineers to accommodate units furnished by a manufacturer other than manufacturer named as basis of design.

### 1.06 DELIVERY, STORAGE, AND HANDLING

A Unit shall be shipped with doors screwed shut and outside air hood closed to prevent damage during transport and thereafter while in storage awaiting installation.

B Follow Installation, Operation, and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location.

C Unit shall be stored in a clean, dry place protected from construction traffic in accordance with the Installation, Operation, and Maintenance manual.

**1.07 WARRANTY**

A Manufacturer shall provide a limited "parts only" warranty for a period of 12 months from the date of equipment startup or 18 months from the date of original equipment shipment from the factory, whichever is less. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer's written instructions for Installation, Operation, and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts and filters.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS:**

A AAON
B Addison
C Captive-Aire
D Desert Aire
E Greenheck
F Johnson
G Trane
H Tempmaster
I Or Approved Equal
J Substitute equipment may be considered for approval that includes at a minimum:
1. R-410A refrigerant
2. Variable capacity compressor with 15-100% capacity control
3. Direct drive supply fans
4. Double wall cabinet construction
5. Insulation with a minimum R-value of 13.0
6. Stainless steel drain pans

**2.02 ROOFTOP UNITS**

A General Description
1. Packaged rooftop unit shall include compressors, evaporator coils, filters, supply fans, dampers, air-cooled condenser coils, condenser fans, reheat coil, exhaust fans, and unit controls.
2. Unit shall be factory assembled and tested including leak testing of the DX coils, pressure testing of the refrigeration circuit, and run testing of the completed unit. Run test report shall be supplied with the unit in the service compartment's literature pocket.
3. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.
4. Unit components shall be labeled, including refrigeration system components and electrical and controls components.
5. Estimated sound power levels (dB) shall be shown on the unit ratings sheet.
6. Installation, Operation, and Maintenance manual shall be supplied within the unit.
7. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's hinged access door.
8. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's hinged access door.

B Performance
1. Refer to Schedule on Drawings for equipment capacities, ambient conditions, etc.
2. Unit performance shall be rated in accordance with AHRI 920. Manufacturer shall provide the Integrated Seasonal Moisture Removal Efficiency (ISMRE). Efficiency shall comply with ASHRAE 90.1-2016.

C Construction
1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.
2. 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 D1929-11.

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. 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. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.
5. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.
6. Access to filters, dampers, cooling coils, reheat coil, exhaust fans, energy recovery wheels, compressors, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors.
7. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
8. Units with cooling coils shall include double sloped 304 stainless steel drain pans.
9. Unit shall be provided with horizontal discharge and return air openings. All openings through the base pan of the unit shall have upturned flanges of at least 1/2 inch in height around the opening.
10. Unit shall include lifting lugs on the top of the unit.

D Electrical

1. Unit shall be provided with factory installed and factory wired, non-fused disconnect switch.
2. Unit shall be provided with a factory installed and factory wired 115V, 12 amp GFI outlet disconnect switch in the unit control panel.
3. Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage or on phase reversal.

E Motorized Dampers

1. Frame shall be constructed of a 16 gage galvanized steel hat-channel.
2. Blades shall be constructed of 16 gage galvanized steel strengthened by three longitudinal 1 inch deep “vee” grooves.
3. Blades shall be symmetrical relative to its axle pivot point.
4. Axle bearings shall be synthetic sleeve-type and rotate inside extruded holes in the damper frame.
5. Blade seals shall be extruded vinyl permanently bonded to the appropriate blade edges.
6. Frame shall include flexible stainless steel compression-type jamb seals.
7. Modulating spring-return actuators shall be provided by the factory, installed on the damper, and wired to the control center. Each damper shall have a dedicated actuator. Single actuators with gear trains are not acceptable.
8. Damper leakage shall be no more than 3 cfm/sq.ft. at 1 in.wg static pressure.

F Supply Fans (VFD)

1. Unit shall include direct drive, unhoused, backward curved, plenum supply fans.
2. Blowers and motors shall be dynamically balance and mounted on rubber isolators.
3. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
4. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.
5. Fan wheel shall be tested in accordance to AMCA 210.

G Exhaust Fans (VFD)

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 direct drive or belt driven, unhoused, backward curved, plenum exhaust fans.
6. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.

H Total Enthalpy Wheel - Silica Gel Dessicant

1. Energy recovery shall be an integral part of unit from the manufacturer. No field assembly, ducting, or wiring shall be required with the energy recovery option.
2. Energy recovery media shall be accessible through a 2" thick, foam-injected, double-wall, hinged access door with quarter-turn latches.
3. Energy recovery shall be provided through a total enthalpy wheel providing sensible and latent energy transfer per the scheduled performance.
4. Energy recovery wheel shall be constructed of lightweight polymer substrate with permanently-bonded silica gel desiccant.
5. Energy recovery wheel cassette shall be mounted perpendicular (90°) to the base of the unit.
6. A VFD shall be required to modulate the speed of the wheel and to provide soft start to extend the life of the belt.
7. Individual pie-shaped wheel sections shall be removable from wheel cassette for maintenance.
8. Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours.
9. Rim shall be continuous rolled stainless steel and the wheel shall be connected to the shaft by means of taper locks.
10. Energy wheel cassette shall include seals, drive motor, and urethane drive belt.
11. Latent energy shall be transferred entirely in the vapor phase with no condensation.
12. The energy recovery cassette and wheel drive motor shall be an Underwriters Laboratories Recognized Component for electrical and fire safety.
13. Thermal performance shall be certified by the wheel 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.

I Cooling Coils

1. DX Evaporator Coils
    a. Coil shall be rated in accordance to AHRI standards, designed to withstand 250 psig working pressure at 300 degrees F, and pressure tested to 600 psig.
    b. Coils shall be designed for use with R-410A refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.
    c. Coils shall have interlaced circuitry and shall be standard capacity.
    d. Coils shall have interlaced circuitry and shall be minimum 6 row high capacity.
    e. Coils shall be hydrogen or helium leak tested.
    f. Coils shall be furnished with factory installed expansion valves.
    g. Cooling coils shall include corrosion-resistant, electrostatically-applied coating rated for 5,000 hours in accordance with ASTM B117.

J Gas Heating:

1. Unit shall be provided with AGA-certified, induced-draft, 3:1 or 6:1 or 5:1 or 10:1 turndown indirect gas furnace. Unit shall be provided with AGA-certified, induced-draft, 10:1 turndown indirect gas furnace.
2. Furnace assembly shall include the following items:
    a. Electronic modulating gas valve.
    b. Two-speed combustion fan.
    c. Stainless steel heat exchanger.

K Hot Gas Reheat Coil

1. Hot-gas reheat coil shall be separated from the evaporator coil by a minimum of 6” in the direction of airflow to prevent the re-evaporation of condensate, provide room for coil cleaning, and allow control system to monitor evaporator coil leaving dew point temperature.
2. Coil shall be rated in accordance to AHRI standards, designed to withstand 250 psig working pressure at 300 degrees F, and pressure tested to 600 psig.
3. Coil casing shall be constructed of 16 gage galvanized steel or 304 stainless steel.
4. Coil tubes shall be constructed of 5/16" diameter, 0.012" thick seamless copper tubing.
5. Coil fins shall be constructed of 0.0060" thick aluminum fins.
6. Hot-gas reheat shall be controlled through a factory-supplied and controlled modulating 3-way valve.
7. Coil shall be hydrogen or helium leak tested.
8. Hot-gas reheat coil shall include corrosion-resistant, electrostatically-applied coating rated for 5,000 hours in accordance with ASTM B117.

L Refrigeration System

1. Unit shall be factory charged with R-410A refrigerant.
2. Compressors shall be scroll type with thermal overload protection and carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory.
3. Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged compressor access doors shall be fabricated of double wall, rigid polyurethane foam injected panels to prevent the transmission of noise outside the cabinet.
4. Compressors shall be isolated from the base pan with the compressor manufacturer’s recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.
5. Each refrigeration circuit shall be equipped with expansion valve type refrigerant flow control.
6. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides and a factory installed replaceable core liquid line filter driers.
7. Unit shall include a variable capacity scroll compressor on the lead refrigeration circuit which shall be capable of modulation from 10-100% of its capacity.
8. Lead refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a control signal terminal which allow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space.
9. Unit shall be configured as an air-source heat pump. Each refrigeration circuit shall be equipped with a factory installed liquid line filter drier with check valve, reversing valve, accumulator, and expansion valves on both the indoor and outdoor coils. Reversing valve shall energize during the heat pump cooling mode of operation.

M Condensers

1. Air-Cooled Condenser
   a. Condenser fans shall be a vertical discharge, axial flow, direct drive fans.
   b. Coils shall be designed for use with R-410A refrigerant. Coils shall be multi-pass and fabricated from aluminum microchannel tubes.
   c. Heat pump outdoor coil shall be constructed of copper tubes with aluminum fins mechanically bonded to the tubes and aluminum end casings. Fin design shall be sine wave rippled.
   d. Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.
   e. Coils shall be hydrogen or helium leak tested.
   f. Condenser coils shall include corrosion-resistant, electrostatically-applied coating rated for 5,000 hours in accordance with ASTM B117.
   g. Condenser fans shall be high efficiency electrically commutated motor driven with factory installed head pressure control module. Condenser airflow shall continuously modulate based on head pressure and cooling operation shall be allowed down to 35°F with adjustable compressor lockout.

h. Condenser fans shall be VFD driven variable speed for condenser head pressure control. Factory provided and factory programmed VFDs shall continuously modulate the fan air flow to maintain head pressure at acceptable levels. Cooling operation shall be allowed down to 35°F with adjustable compressor lockouts.

N Filters

1. Outdoor air hood shall have a aluminum mesh filter section.
2. Unit shall include 2 inch thick, pleated panel filters with an ASHRAE efficiency of 30% and MERV rating of 13, upstream of the cooling coil.
3. Unit shall include 0-100% economizer consisting of a motor operated outside air damper and return air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven and designed to have no more than 20 cfm of leakage per sq ft. at 4 in. w.g. air pressure differential across the damper. Low leakage dampers shall be Class 2 AMCA certified, in accordance with AMCA Standard 511. Damper assembly shall be controlled by spring return enthalpy activated fully modulating actuator. Unit shall include outside air opening bird screen, outside air hood, and barometric relief dampers.
4. Economizer shall be furnished with return air CO2 override.

O Controls

1. Factory Installed Controller
   a. The unit shall come with a factory programmed and supplied controller that provide all programming and functionality for the unit to operate, including internal safeties.
   b. All sensors required for the operation of the unit shall be factory furnished. This includes outside air temperature and humidity sensors, supply air temperature and humidity sensors, coil suction pressure and temperature sensors, space temperature and humidity sensors, preheat discharge temperature sensor, and other sensors as required to implement the sequence of operations. Refer to sequence on Drawings.

P Accessories

1. Unit shall be provided with a smoke detector in the supply of the unit, wired to shut off the unit's control circuit.

**2.03 CURBS**

A Curbs shall 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. Curb gasket shall be furnished within the control compartment of the rooftop unit to be mounted on the curb immediately before mounting of the rooftop unit.

B Height of curb shall be at least the minimum required to accommodate the horizontal discharge openings.

C Solid bottom curb shall be factory assembled and fully lined with 1 inch neoprene coated fiberglass insulation and include a wood nailer strip. Curb shall be adjustable up to 3/4 inch per foot to allow for sloped roof applications.

D Curb shall be rated for the project wind zone.

**PART 3 EXECUTION**

**3.01 INSTALLATION, OPERATION, AND MAINTENANCE**

A Installation, Operation, and Maintenance manual shall be supplied with the unit.

B Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

C Examine casing insulation materials and filter media before air-to-air energy recovery equipment installation. Reject insulation materials and filter media that do not comply, or are wet, moisture damaged, or mold damaged.

D Install units with clearances for service and maintenance.

E Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

F Installing contractor shall install unit, including field installed components, in accordance with Installation, Operation, and Maintenance manual instructions.

G Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.

**3.02 OWNER TRAINING**

A Location: Job site

B An authorized manufacturer's representative shall conduct the training session.

C Provide minimum four (4) hours training for six (6) people.

D Provide video recording of the training session. Turn over video to Owner at the conclusion of the project.

**END OF SECTION 23 74 00**

# SECTION 23 81 19
# SELF-CONTAINED AIR-CONDITIONERS

**<<<< UPDATE NOTES**

## PART 1 GENERAL

### 2.01 SECTION INCLUDES

A Packaged terminal heat pump units.
B Wall sleeves.
C Louvers.
D Controls.

### 2.02 RELATED REQUIREMENTS

A Section 26 05 83 - Wiring Connections: Installation of thermostats and other control components.
B Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

### 2.03 REFERENCE STANDARDS

A AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2023.

### 2.04 SUBMITTALS

A See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B Product Data: Provide drawings indicating dimensions, rough-in connections, and electrical characteristics and connection requirements.
C Manufacturer's Instructions: Include assembly instructions, support details, connection requirements, and start-up instructions.
D Operation and Maintenance Data: Provide maintenance data, parts lists, controls, and accessories. Include trouble-shooting guide.
E Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

### 2.05 WARRANTY

A See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
B Provide a five year warranty to include coverage for refrigeration compressors.

## PART 2 PRODUCTS

### 3.01 MANUFACTURERS

### 3.02 AIR CONDITIONING UNITS

A Description: Packaged, self-contained, through-the-wall air cooled terminal air conditioning units, with wall sleeve, room cabinet, electric refrigeration system, electric heating, outside air louvers, built-in temperature controls; fully charged with refrigerant and filled with oil.
B Electrical Characteristics:
C Energy Efficiency:

### 3.03 CABINET

A Cabinet: Wall mounted of 18 gauge, 0.0478 inch galvanized steel with epoxy coated finish, removable front panel with concealed latches, color as selected.
B Discharge Grille and Access Door: Removablepunched louver discharge grilles, allowing 4-way discharge air pattern with hinged door in top of cabinet for access to controls.

### 3.04 WALL SLEEVES AND LOUVERS

A Wall Sleeves: 16 inches deep, 16 gauge, 0.0598 inch galvanized steel with protective mastic coating.
B Louvers: Provide flush anodized aluminum with enamel finish, color as selected.

### 3.05 CHASSIS

A Refrigeration System:
1. Direct expansion cooling coil.
2. Hermetically sealed compressor with internal spring isolation, external isolation, permanent split capacitor motor and overload protection.
3. Accumulator.

B Air System: Centrifugal forward curved tangential evaporator fans with two speed permanent split capacitor motor, permanent washable filters, positive pressure ventilation damper with concealed manual operator.

C Condensate Drain: Drain pan to direct condensate to condenser coil for re-evaporation.

**3.06 CONTROLS**

A Control Module: Unit mounted adjustable thermostat with heat anticipator, heat-off-cool switch, high-low fan switch.

**PART 3 EXECUTION**

**4.01 INSTALLATION**

A Install in accordance with manufacturer's instructions.

B Coordinate installation of units with architectural, mechanical, and electrical work.

**END OF SECTION 23 81 19**

# SECTION 23 81 26.13
# SMALL-CAPACITY SPLIT-SYSTEM AIR CONDITIONERS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Air cooled condensing units.

B Indoor air handling (fan and coil) units for ductless systems.

C Controls.

### 1.02 RELATED REQUIREMENTS

A Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections and installation and wiring of thermostats and other controls components.

### 1.03 REFERENCE STANDARDS

A AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2023.

B AHRI 520 - Performance Rating of Positive Displacement Condensing Units; 2004.

C ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2022, with Errata (2023).

D ASHRAE Std 23 - Methods for Performance Testing Positive Displacement Refrigerant Compressors and Compressor Units; 2022.

E NEMA MG 1 - Motors and Generators; 2021.

F NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

G NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

H UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

### 1.04 SUBMITTALS

A See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

C Design Data: Indicate refrigerant pipe sizing.

D Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

E Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

F Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

G Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Extra Filters: One for each unit.

### 1.05 WARRANTY

A See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B Provide three year manufacturers warranty for solid state ignition modules.

## PART 2 PRODUCTS

### 2.01 SYSTEM DESIGN

A Ductless Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.

1. Heating: None.
2. Cooling: Outdoor electric condensing unit with evaporator coil in central ducted indoor unit.
3. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.

B Performance Requirements: See Drawings for additional requirements.

C Electrical Characteristics:

1. Disconnect Switch: Factory mount disconnect switch on equipment under provisions of Section 26 05 83.

### 2.02 INDOOR AIR HANDLING UNITS FOR DUCTLESS SYSTEMS

A Manufacturers:

1. Mitsubishi; MSY:

B Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer.
1. Location: High-wall.
2. Cabinet: Galvanized steel.
a. Finish: White.
3. Fan: Line-flow fan direct driven by a single motor.

C Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
2. Provide Epoxy coating for seacoast protection.
3. Manufacturer: System manufacturer.

**2.03 OUTDOOR UNITS**

A Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
1. Comply with AHRI 210/240.
2. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.
3. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.
4. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23 and UL 207.

B Compressor: Hermetic, two speed 1800 and 3600 rpm, AHRI 520 resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high-pressure control, motor overload protection, service valves and drier. Provide time delay control to prevent short cycling and rapid speed changes.

C Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard. Provide epoxy coating for seacoast protection.

D Accessories: Filter drier, high-pressure switch (manual reset), low pressure switch (automatic reset), service valves and gauge ports, thermometer well (in liquid line).
1. Provide thermostatic expansion valves.

E Operating Controls:
1. Control by room thermostat to maintain room temperature setting.

F Mounting Pad: Precast concrete parking bumpers, minimum 4 inches square; minimum of two located under cabinet feet.

**2.04 ACCESSORY EQUIPMENT**

A Room Thermostat: Wall-mounted, electric solid state microcomputer based room thermostat with remote sensor to maintain temperature setting; low-voltage; with following features:
1. Automatic switching from heating to cooling.
2. Preferential rate control to minimize overshoot and deviation from setpoint.
3. Thermostat Display:
a. Actual room temperature.
b. System Mode Indication: Heating, Cooling, Fan Auto, Off, and On, Auto or On, Off.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.

B Verify that proper power supply is available and in correct location.

C Verify that proper fuel supply is available for connection.

**3.02 INSTALLATION**

A Install in accordance with NFPA 90A and NFPA 90B.

B Install refrigeration systems in accordance with ASHRAE Std 15.

**END OF SECTION 23 81 26.13**

# SECTION 23 82 00
# CONVECTION HEATING AND COOLING UNITS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Electric unit heaters.

B Blower-coil units.

### 1.02 RELATED REQUIREMENTS

A Section 03 30 00 - Cast-in-Place Concrete.

B Section 23 05 13 - Common Motor Requirements for HVAC Equipment.

C Section 23 07 19 - HVAC Piping Insulation.

D Section 23 09 13 - Instrumentation and Control Devices for HVAC.

E Section 23 09 93 - Sequence of Operations for HVAC Controls.

F Section 23 21 13 - Hydronic Piping.

G Section 23 21 14 - Hydronic Specialties.

H Section 23 23 00 - Refrigerant Piping.

I Section 23 31 00 - HVAC Ducts and Casings.

### 1.03 REFERENCE STANDARDS

A AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI); Current Edition.

B AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils; 2001, with Addenda (2011).

C NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

D SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

### 1.04 SUBMITTALS

A See Section 01 30 00 - Administrative Requirements for submittal procedures.

B Product Data: Provide typical catalog of information including arrangements.

C Shop Drawings:

1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
2. Indicate air coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.
3. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
4. Submit the following for blower-coil units indicating:
    a. Overall dimensions including installation, operation, and service clearances.
    b. Lift points, recommendations, and center of gravity.
    c. Unit shopping, installation, and operating weights including dimensions.
    d. Fan curves with specified operating point clearly plotted.
    e. Safety and start-up instructions.

D Manufacturer's Instructions: Indicate installation instructions and recommendations.

E Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access or valving.

F Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

G Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

### 1.05 QUALITY ASSURANCE

A Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

### 1.06 WARRANTY

A See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

**PART 2 PRODUCTS**

**2.01 ELECTRIC UNIT HEATERS**

A Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to authority having jurisdiction as suitable for purpose indicated.

B Heating Element Assembly:
1. Thermal safety cut-out within electric terminal box with automatically reset switch located near electric terminal box.

C Housing:
1. Suitable for ceiling or high altitude mount using provided hardware appendages.

D Air Inlets and Outlets:
1. Inlets: Provide stamped louvers or protective grilles with fan blade guard.
2. Outlets: Provide diffuser cones, directional louvers, or radial diffusers.

E Fan: Factory balanced, direct drive, axial type with fan guard.

F Motor: Totally enclosed, thermally protected, and provided with permanently lubricated bearings.

G Controls:

H Electrical Characteristics:

**2.02 BLOWER-COIL UNITS**

A Manufacturers:
1. Carrier Corporation; _____: www.commercial.carrier.com/#sle.
2. Johnson Controls International, PLC; _____: www.johnsoncontrols.com/#sle.
3. Krueger-HVAC; _____: www.krueger-hvac.com/#sle.
4. Trane Technologies, PLC; _____: www.trane.com/#sle.

B Performance Data and Safety Requirements:
1. Coils rated and tested in accordance with AHRI 410.
2. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to authority having jurisdiction as suitable for purpose indicated.
3. Comply with NFPA 90A for unit construction, including filters and related equipment, for protection of life and property from fire, smoke, and gases resulting from conditions having manifestations similar to fire.

C Unit Casing:
1. Fabricate from heavy gauge galvanized steel sheet.
2. Insulate inside walls with 1 inch thick, fiberglass insulation for thermal and acoustical control.
3. Provide access panels allowing servicing of coils, drain pan, fan, motor, and drive.
4. Provide knockouts or hanger rod holes at all four corners for suspended units.

D Air Coils:
1. Aluminum fins mechanically expanded or bonded to copper tubes having standard sweat connections.
   a. Water: Manual, automatic or self-venting, designed to a working pressure and temperature of not less than 250 psig and 200 degrees F.
   b. Direct Expansion (DX): Thermal expansion valve and distributor, dehydrated, sealed with dry charge, and factory proof tested for leaks.
   c. Provide Epoxy coating for seacoast protection

E Fans: Forward curved, centrifugal blower, dynamically balanced, adjustable speed V-belt drive with fan shaft supported by heavy-duty, permanently sealed ball bearings.

F Drain Pan: Cleanable, one-piece construction of polymer, galvanized steel, or stainless steel; with drain connection and sloped for positive drainage.

G Filters: Fully accessible, flat filter rack with throw-away filters.

H Motors: Single speed with sleeve or ball bearings, 1,750 rpm, wired to unit junction box, and mounted on a resilient motor base.

I Mixing Box: Factory assembled fresh air and return air dampers including linkage and ready for field installation of damper actuator.

J Electrical Controls:

K Electrical Characteristics:

## PART 3 EXECUTION

### 3.01 EXAMINATION

A Verify that surfaces are suitable for installation.

B Verify that field measurements are as indicated on drawings.

### 3.02 PREPARATION

A Provide housekeeping pads for blower-coil units under provisions of Section 03 30 00.

### 3.03 INSTALLATION

A Install in accordance with manufacturer's recommendations.

B Do not damage equipment or finishes.

C Blower-Coil Units:

1. Verify all surfaces and openings at unit location can suitably accommodate unit(s).
2. Install in accordance with manufacturer's recommendations.
3. Provide manual shut-off valve on hydronic supply side of coil and balancing valve with memory stop on return side.
4. General piping installation requirements are specified in other Sections and drawings indicate general arrangement of piping, fittings, and specialties.
5. Connect hydronic, condensate drain, and overflow drain piping to unit.

### 3.04 CLEANING

A After construction and painting is completed, clean exposed surfaces of units.

B Vacuum clean coils and inside of units.

C Touch-up marred or scratched surfaces of factory-finished cabinets using finish materials furnished by the manufacturer.

D Install new filters.

### 3.05 CLOSEOUT ACTIVITIES

A See Section 01 78 00 - Closeout Submittals for closeout submittals.

B See Section 01 79 00 - Demonstration and Training for additional requirements.

**END OF SECTION 23 82 00**

# SECTION 26 00 02
# ELECTRICAL PREFERRED ALTERNATES

## PART 1 GENERAL

### 1.01 LIST OF ALTERNATES

A Refer to Architect's Division 01 Specification for Bid Alternates.

**END OF SECTION 26 00 02 26 00 02**

# SECTION 26 01 00
# ELECTRICAL GENERAL PROVISIONS

## PART 1 GENERAL

### 1.01 SCOPE OF WORK

A This Contractor shall provide all materials, equipment and labor necessary to install and set into operation the electrical equipment as shown on the Engineering Drawings and as contained herein.

### 1.02 QUALITY ASSURANCE

A See the General and Supplementary General Conditions and Architectural Divisions.

B All work shall be in accordance with the North Carolina State Building Code, which includes the 2020 edition of the National Electrical Code.

C The Contractor shall be responsible for obtaining all permits and shall notify inspection departments as work progresses.

D Wherever the words "Approved", "Approval", and "Approved Equal" appear, it is intended that items other than the model numbers specified shall be subject to the approval of the Engineer.

E "Provide" as used herein shall mean that the Contractor responsible shall furnish and install said item or equipment. “Furnish" as used herein shall mean that the Contractor responsible shall acquire and make available said item or equipment and that installation shall be by others. "Install" as used herein shall mean that the Contractor responsible shall make installation of items or equipment furnished by others.

F All personnel under this Contractor’s supervision shall be qualified to perform those portions of the work assigned to them. Personnel (including project managers) deemed to be negative to the overall success of the project shall be removed from the project and replaced with qualified personnel who will be positive for the project. Upon written notification that particular personnel have been deemed negative to the overall success of the project, this Contractor shall immediately replace such particular personnel. The engineer shall be sole arbiter and any decision regarding fitness of this Contractor’s personnel for this project shall not be subject to appeal.

### 1.03 SUBMITTALS

A See General and Supplementary General Conditions and Division 1.

B Within ten (10) days after notification of the award of the Contract and written notice to begin work, the Contractor shall submit for approval to the Architect/Engineer a detailed list of equipment and material which he proposes to use.

C The Contractor shall provide an electronic pdf copy of the submittal data on the products, methods, etc. proposed for use on the project. The submittal shall contain complete submittal data on all products, methods, etc. proposed for use on the project.

D Each submittal shall bear the approval of the Contractor indicating that he has reviewed the data and found it to meet the requirements of the specifications as well as space limitations and other project conditions. The submittals shall be clearly identified showing project name, manufacturer's catalog number and all necessary performance and fabrication data. Detailed submittal data shall be provided when items are to be considered as substitution for specified items. Acceptance for approval shall be in writing from the Engineer.

E The Contractor shall submit to the Engineer a set of accurately marked-up plans indicating all changes encountered during the construction. Final payment will be contingent on receipt of these as-built plans.

F The Contractor shall furnish an electronic copy of maintenance and operating instructions.

G The Contractor shall submit to the Engineer a duplicate set of final electrical inspection certificates prior to final payment.

### 1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A All material and equipment shall be delivered and unloaded by the Contractor within the project site as noted herein or as directed by the Owner.

B The Contractor shall protect all material and equipment from breakage, theft or weather damage. No material or equipment shall be stored on the ground.

C The material and equipment shall remain the property of the Contractor until the project has been completed and turned over to the Owner.

D Where equipment cannot be stored at the site due to exposure to the elements or lack of storage space , the contractor shall store all equipment in a bonded warehouse until the time of installation.

**1.05 WORK CONDITIONS AND COORDINATION**

A The Contractor shall review the entire set of plans to establish points of connection and the extent of electrical work to be provided in his Contract.

B The contractor is responsible for reviewing the complete set of contract documents. Coordinate all phasing requirements with architectural drawings. Coordinate equipment locations and utility routing with all trades to ensure code compliance and constructibility.

C This Contractor shall be responsible for all electrical work and make final connections to equipment installed in his Contract.

D Pipe, conduit and duct chases required for installation of work shall be provided by the General Contractor unless otherwise noted. This Contractor shall be responsible for coordinating the location of all required chases.

E All work shall be coordinated with other trades. Cutting of new work and subsequent patching shall be approved by Architect/ Engineer and shall be at the Contractor's expense with no extra cost to the Owner.

**1.06 GUARANTEE**

A See the General and Supplementary General Conditions.

B Where extended warranties or guarantees are available from the manufacturer, the Contractor shall prepare the necessary Contract Documents to validate these warranties as required by the manufacturer and present them to the Architect/Engineer.

**PART 2 PRODUCTS**

**2.01 MATERIAL QUALITY**

A Material and equipment shall be new, unless noted otherwise, of the highest grade and quality and free from defects or other imperfections. Material and equipment found defective shall be removed and replaced at the Contractor's expense.

**2.02 EQUIPMENT LISTINGS**

A All materials and equipment shall be third party listed by an agency accredited by the NCBCC and NC Department of Insurance (NC DOI). The list of accredited agencies may be obtained on NCDOI's web site.

**PART 3 EXECUTION**

**3.01 INSPECTION**

A If any part of this Contractor's work is dependent for its proper execution or for its subsequent efficiency or appearance on the character or conditions of contiguous work not executed by him, the Contractor shall examine and measure such contiguous work and report to the Architect or Engineer in writing any imperfection therein, or conditions that render it unsuitable for the reception of this work. Should the Contractor proceed without making such written report, he shall be held to have accepted such work and the existing conditions and he shall be responsible for any defects in this work consequent hereon and will not be relieved of the obligation of any guarantee because of any such imperfection or condition.

B After the designer pre-final inspection and confirmation that the final punch list items have been completed. The contractor shall schedule a final electrical inspection with the local inspections office.

**3.02 INSTALLATION**

A All work shall be performed in a manner indicating proficiency in the trade.

B All conduit, pipes, ducts, etc., shall be either parallel to building walls or plumb where installed in a vertical position and shall be concealed when located in architecturally finished areas.

C Any cutting or patching required for installation of this Contractor's work shall be kept to a minimum. Written approval shall be required by the Architect/Engineer if cutting of primary structure is involved.

D All patching shall be done in such a manner as to restore the areas or surfaces to match existing finishes.

E The Contractor shall lay-out and install his work in advance of pouring concrete floors or walls. He shall furnish and install all sleeves or openings through poured masonry floors or walls above grade required for passage of all conduits, pipes or duct installed by him. The Contractor shall furnish and install all inserts and hangers required to support his equipment.

F The Contractor shall be responsible for removing all spray-on fireproofing overspray from all equipment, light fixtures, and all other materials provided as part of the electrical contract.

**3.03 PERFORMANCE**

A The Contractor shall perform all excavation and backfill operations necessary for installation of his work.

B Rock excavation shall be defined in the Supplementary General Conditions, Division 1 or Division 2. Unless specifically stated, neither rock excavation nor a unit price for rock excavation shall be required in the bid.

**3.04 ERECTION**

A All support steel, angles, channels, pipes or structural steel stands and anchoring devices that may be required to rigidly support or anchor material and equipment shall be provided by this Contractor.

**3.05 FIELD QUALITY CONTROL**

A The Contractor shall conform to the requirements of Division 3 for concrete testing.

B The Contractor shall test his entire installation and shall furnish the labor and materials required for these tests. Tests shall be performed in accordance with the requirements of the particular section of the specifications and in accordance with the requirements of the State Ordinances and Codes, and the National Electrical Code. The Contractor shall notify the Architect or Engineer of his readiness for such test. A final inspection by the Electrical Inspector or Local Authority Having Jurisdiction is required, and an inspection certificate is required prior to authorization of final payment.

C Testing required for compliance with the Contract shall be stated in subsequent sections.

D All tests specified shall be completely documented indicating time of day, date, temperature and all other pertinent test information including the entity conducting the test.

E All required documentation of readings required by each test shall be submitted to the Engineer prior to, and as one of the prerequisites for, final acceptance of the project.

**3.06 ADJUST AND CLEAN**

A All equipment and installed materials shall be thoroughly clean and free of all dirt, oil, grit, grease, etc.

B Factory painted equipment shall not be repainted unless damaged areas exist. These areas shall be touched up with a material suitable for the intended service. In no event shall nameplates be painted.

C At a scheduled meeting, the Contractor shall instruct the Owner or the Owner's representative in the operation and maintenance of all equipment installed under his Contract (in the presence of the Engineer).

**3.07 MAINTENANCE AND OPERATING MANUAL**

A The Contractor shall prepare an electronic submission of a manual describing the proper maintenance and system operation. This manual shall not consist of standard factory printed data intended for dimension or design purposes (although these may be included), but shall be prepared to describe this particular job. This manual shall include the following:

B Data on all equipment as listed on the fixture and equipment schedules on the plans. Also data on all fire alarm, VOIP/Data network system, public address system, security system, lighting control systems, I/P Camera system, battery backup system, Bi-Directional Amplification (BDA), etc. that are applicable for the project.

C Warranties as required for each product.

D A check list for periodic maintenance of all equipment requiring maintenance. (i.e., fire alarm system, security system, generator, battery backup system, etc.)

E Maintenance and spare parts data for all equipment.

F As-Built wiring for equipment containing field wired systems. (i.e., fire alarm, security, data system, camera, public address, etc.)

G The manuals shall be dated and signed by the Contractor when completed.

H The operating and maintenance manuals shall be submitted to the Engineer for approval. When the manuals are considered complete by the Engineer, they will be turned over to the Owner for their permanent use.

**END OF SECTION 26 01 00 26 01 00**

# SECTION 26 05 05
# ELECTRICAL DEMOLITION

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Electrical demolition.

## PART 2 PRODUCTS

### 2.01 MATERIALS AND EQUIPMENT

A Materials and equipment for patching and extending work.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A Verify field measurements and circuiting arrangements are as indicated.

B Report discrepancies to Architect before disturbing existing installation.

### 3.02 PREPARATION

A Disconnect electrical systems in walls, floors, and ceilings to be removed.

B Coordinate utility service outages with utility company.

C Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.

1. Obtain permission from Owner at least 48 hours before de-energizing system.

E Fire alarm system shall be maintained to all occupied portions of the building.

1. Notify Owner and Fire Marshall a least 48 hours before partially or completely disabling system.
2. If the Fire alarm system cannot be maintained in the occupied portion of the building contractor shall provide a fire watch in accordance with NFPA 72 and local authority requirements.

### 3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Lamps are to be disposed of in accordance with NC G.S. 130A - 310.60. Applicable equipment and materials include, but are not limited to:

1. PCB-containing electrical equipment, including transformers, capacitors, and switches.
2. PCB- and DEHP-containing lighting ballasts.
3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.

B Remove, relocate, and extend existing installations to accommodate new construction.

C Remove abandoned wiring to source of supply.

D Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Where conduit cannot be removed from floors or walls, cut conduit flush with walls and floors, and patch surfaces.

E Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

F Disconnect and remove abandoned panelboards and distribution equipment.

G Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

H Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

I Repair adjacent construction and finishes damaged during demolition and extension work.

J Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

K Remove all devices from walls or ceilings shown to be removed on the Architectural drawings whether shown on the electrical demolition plans or not.

L Where existing downstream devices are to remain, extend existing branch circuit conduit and conductors to maintain service.

M Extend existing installations using materials and methods as specified.

**3.04 CLEANING AND REPAIR**

A Clean and repair existing materials and equipment that remain or that are to be reused.

**END OF SECTION 26 05 05**

# SECTION 26 05 19
# POWER CONDUCTORS AND CABLES

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Single conductor building wire.
B Underground feeder and branch-circuit cable.
C Wiring connectors.
D Electrical tape.
E Oxide inhibiting compound.
F Wire pulling lubricant.

### 1.02 REFERENCE STANDARDS

A ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).
B ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2023.
C ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).
D ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).
E NFPA 70 - National Electrical Code; National Fire Protection Association, Including All Applicable Amendments and Supplements; 2020.

### 1.03 SUBMITTALS

A Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
B Field Quality Control Test Reports.
C Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
D Project Record Documents: Record actual installed circuiting arrangements. Record actual routing of exterior below grade conduit and associated hand holes or man holes..
E Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

### 1.04 QUALITY ASSURANCE

A Comply with requirements of NFPA 70.
B Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
C Product Listing Organization Qualifications: Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label Electrical and Mechanical Equipment.

### 1.05 DELIVERY, STORAGE, AND HANDLING

A Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

### 1.06 FIELD CONDITIONS

A Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

## PART 2 PRODUCTS

### 2.01 CONDUCTOR AND CABLE APPLICATIONS

A Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
B Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
C Nonmetallic-sheathed cable is not permitted.
D Service entrance cable is not permitted.

### 2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A Provide products that comply with requirements of NFPA 70.

B Provide products listed, classified, and labeled as suitable for the purpose intended.

C All conductors shall be labeled two feet on centers indicating size, type, voltage, rating, and manufacturer's name.

D Provide new conductors and cables manufactured not more than one year prior to installation.

E Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

F Comply with NEMA WC 70.

G Conductor Material:

1. Provide copper conductors only! Conductor sizes indicated are based on copper.
2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors.

H Minimum Conductor Size:12 AWG.

I Maximum Conductor Size: 500 kcmil

J Conductors for branch circuits shall be sized to prevent a voltage drop exceeding three percent (3%) at the farthest outlet of power, heating and lighting loads, or any combination of such loads. The maximum total voltage drop on both feeders and branch circuits to the farthest outlet shall not exceed five percent (5%).

1. Where the branch circuit conductor length from the panel to the first outlet on a 277 volt circuit exceeds 125 feet, the branch circuit conductors from the panel to the first outlet shall not be smaller than #10 AWG. Increase the branch circuit conductor size an additional wire size for reach 125' of additional length of the entire circuit. The ground conductor size shall be increased proportionately to the increase in the phase conductors per 2020 NEC 250.122(B).
2. Where the conductor length from the panel to the first outlet on a 120 volt circuit exceeds 50 feet, the branch circuit conductors from the panel to the first outlet shall not be smaller than #10 AWG. Increase the branch circuit conductor size an additional wire size for reach 100' of additional length of the entire circuit. The ground conductor size shall be increased proportionately to the increase in the phase conductors per 2020 NEC 250.122(B).

K Conductor Color Coding:

1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method:
   a. Conductors #10 AWG and smaller shall be factory color coded.
   b. Conductors #3 and larger shall be factory color coded on the entire length.
3. Color Code:
   a. 208Y/120 V, 3 Phase, 4 Wire System:
      1) Phase A: Black.
      2) Phase B: Red.
      3) Phase C: Blue.
      4) Neutral/Grounded: White.
   b. Equipment Ground, All Systems: Green.
   c. 0 - 10V Dimming conductors: Violet and Grey

**2.03 BUILDING WIRE**

A Approved Manufacturers as listed below or approved equal:

1. Copper Building Wire:
   a. Triangle
   b. Okonite
   c. Houston Wire and Cable
   d. or approved equal

B Description: Single conductor insulated wire.

C Conductor Stranding:

1. Feeders and Branch Circuits:
   a. Size 10 AWG and Smaller: Solid.
   b. Size 8 AWG and Larger: Class B Stranded.

D Insulation Voltage Rating: 600 V.

E Insulation:
1. Copper Building Wire: Type THHN/THWN or XHHW-2.
2. Conductors routed on roofs or other exterior surface where raceway is exposed to direct sunlight shall be type XHHW-2 insulation.

**2.04 WIRING CONNECTORS**

A Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B Connectors for Grounding and Bonding: Comply with Section 26 05 26.

C Wiring Connectors for Splices and Taps:
1. Splices or taps shall not be allowed for feeder conductors unless specifically noted on plans.
2. Where a splice or tap for feeder conductors is noted on the plans, connectors shall be Blackburn insulated multi-tap or approved equal.
3. Splices in branch circuit conductors shall be allowed in accessible junction boxes, troughs, or gutters.
   a. Copper Conductors #10 AWG and smaller: Use twist-on insulated spring connectors.
   b. Copper Conductors #8 AWG and larger: Use mechanical connectors with gum rubber tape or friction tape. Solderless mechanical connectors with UL listed insulating covers may be used at contractor's option.
4. Use of split bolts is not allowed.
5. "Sta-kon" or other permanent type crimp connectors shall not be used for branch circuit connections.

D Wiring Connectors for Terminations:
1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.

E Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

**2.05 ACCESSORIES**

A Electrical Tape:
1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
   a. Product: Okonite 2000 or approved equal.
2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.

B Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A Verify that interior of building has been protected from weather.

B Verify that work likely to damage wire and cable has been completed.

C Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D Verify that field measurements are as indicated.

E Verify that conditions are satisfactory for installation prior to starting work.

**3.02 PREPARATION**

A Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

**3.03 INSTALLATION**

A Circuiting Requirements:
1. Circuit routing indicated is diagrammatic.
2. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
3. 0 - 10V lighting dimming conductors may not be routed in the same raceway with line voltage conductors.
4. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
5. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
6. A dedicated green equipment grounding conductor shall be provided for all raceways containing branch circuit or feeder conductors. Equipment ground conductor shall be sized in accordance with the NEC.

B Install products in accordance with manufacturer's instructions.

C Install conductors and cable in a neat and workmanlike manner. Neatly train and lace wiring inside boxes, equipment, and panelboards.

D Installation in Raceway:
1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
2. Pull all conductors and cables together into raceway at same time.
3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
4. Use suitable wire pulling lubricant for conductors #4 AWG or larger, except when lubricant is not recommended by the manufacturer.

E Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

F Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

G Install conductors with a minimum of 12 inches of slack at each outlet.

H Neatly train conductors inside boxes, wireways, panelboards and other equipment enclosures. Condcutors shall not be laced or bundled to avoid overheating.

I Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

J Make wiring connections using specified wiring connectors.
1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
2. Do not remove conductor strands to facilitate insertion into connector.
3. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.

K Insulate ends of spare conductors using vinyl insulating electrical tape.

L Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

**3.04 FIELD QUALITY CONTROL**

A All tests shall be completely documented indicating time of day, date, temperature and all pertinent test information. All required documentation shall be submitted to the Engineer prior to, and as a prerequisite for, final acceptance of the project. All test results shall be included in the Owner's operation and maintenance manual.

B Inspect and test in accordance with NETA ATS, Section 7.3.2.
1. Perform each of the following visual and electrical tests:
   a. Compare cable data with drawings and specifications to ensure compliance with contract documents.

b. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
c. Test bolted connections for high resistance using one of the following:
   1) A low-resistance ohmmeter.
   2) Calibrated torque wrench.
d. Inspect compression-applied connectors for correct cable match and indentation.
e. Inspect for correct identification.
f. Inspect cable jacket and condition.
g. Continuity test on each conductor and cable.
h. Uniform resistance of parallel conductors.

C Insulation resistance test is required for all feeder conductors prior to energizing feeders, sub-feeders, or service entrance conductors.

1. All current carrying feeder phase conductors and neutrals shall be tested as installed, and before connections are made, for insulation resistance and accidental grounds. This shall be done with a 500 volt insulation resistance tester. In the procedures listed below shall be followed:
   a. Minimum readings shall be one million (1,000,000) or more ohms for #6 AWG wire and smaller, 250,000 ohms or more for #4 AWG wire or larger, between conducts and between conductor and the grounding conductor.
   b. After all fixtures, devices and equipment are installed and all connections completed to each panel, the Contractor shall disconnect the neutral feeder conductor from the neutral bar and take a insulation resistance reading between the neutral bar and the grounded enclosure. If this reading is less than 250,000 ohms, the Contractor shall disconnect the branch circuit neutral wires from this neutral bar. He shall then test each one separately to the panel and until the low readings are found. The Contractor shall correct troubles, reconnect and retest until at 250,000 ohms from the neutral bar to the grounded panel can be achieved with only the neutral feeder disconnected.
   c. The Contractor shall send a letter to the Engineer certifying that the above has been done and tabulating the insulation resistance readings for each panel. This shall be done at least four (4) days prior to final inspection.
   d. At final inspection, The Contractor shall furnish a insulation resistance tester and show the Engineer's representatives that the panels comply with the above requirements. He shall also furnish a hook-on type ammeter and voltmeter to take current and voltage readings as directed by the representatives.
   e. Results of the test shall be made available to the engineer at the required pre-energization walk through.
2. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

D Correct deficiencies and replace damaged or defective conductors and cables and re-test as indicated above. Contractor shall submit new test results to the Engineer to demonstrate the deficiency has been corrected.

**END OF SECTION 26 05 19**

**SECTION 26 05 26**
**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Grounding and bonding requirements.
B Conductors for grounding and bonding.
C Connectors for grounding and bonding.
D Ground bars.
E Ground rod electrodes.

### 1.02 REFERENCE STANDARDS

A IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.
B NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2022.
C NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
D NFPA 70 - National Electrical Code; National Fire Protection Association, Including All Applicable Amendments and Supplements; 2020.
E UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A Coordination:
1. Verify exact locations of underground metal water service pipe entrances to building.
2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B Sequencing:
1. Do not install ground rod electrodes until final backfill and compaction is complete.

### 1.04 SUBMITTALS

A Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.
B Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
C Field quality control test reports.
D Project Record Documents: Record actual locations of grounding electrode system components and connections.

### 1.05 QUALITY ASSURANCE

A Comply with requirements of NFPA 70.
B Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
C Product Listing Organization Qualifications: Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label Electrical and Mechanical Equipment.

### 1.06 DELIVERY, STORAGE, AND HANDLING

A Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

## PART 2 PRODUCTS

### 2.01 GROUNDING AND BONDING REQUIREMENTS

A Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.
B Do not use products for applications other than as permitted by NFPA 70 and product listing.
C Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding

system.

D Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

E Grounding System Resistance:

1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.

F Grounding Electrode System:

1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
   a. Provide continuous grounding electrode conductors without splice or joint.
   b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
2. Metal Underground Water Pipe(s):
   a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
   b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
   c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
3. Metal In-Ground Support Structure:
   a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
4. Concrete-Encased Electrode:
   a. Where metallic structural components meet the definition of a concrete encased electrode as defined in NEC 250.52, the concrete encased electrode shall be bonded to the grounding electrode system per NEC 250.50. Coordinate with the structure prior to pouring concrete foundations.
   b. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
5. Ground Rod Electrode(s):
   a. Space electrodes not less than 10 feet from each other and any other ground electrode until maximum allowed resistance to ground is achieved.
   b. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
7. Ground Bar: Provide ground bar in main electrical room, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
   a. Ground Bar Size: 1/4" x 2" x 18" unless otherwise indicated or required.
   b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
8. unless otherwise noted. Location as identified on plans.

9. Ground Riser: Provide common grounding electrode conductor not less than 3/0 AWG for tap connections to multiple separately derived systems as permitted in NFPA 70.

G Service-Supplied System Grounding:
1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

H Separately Derived System Grounding:
1. Separately derived systems include, but are not limited to:
   a. Transformers.
2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
4. Where common grounding electrode conductor ground riser is used for tap connections to multiple separately derived systems, provide bonding jumper to connect the metal building frame and metal water piping in the area served by the derived system to the common grounding electrode conductor.
5. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.

I Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
   a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
   b. Metal gas piping.

J Communications Systems Grounding and Bonding:
1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
   a. Bonding Jumper Size: #3/0 AWG.

b. Raceway Size: 1" trade size unless otherwise indicated or required.
c. Ground Bar Size: 1/4" x 2" x 18" unless otherwise indicated or required.
d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

**2.02 GROUNDING AND BONDING COMPONENTS**

A General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 26:
1. Use insulated copper conductors unless otherwise indicated.
a. Exceptions:
1) Use bare copper conductors where installed underground in direct contact with earth.
2) Use bare copper conductors where directly encased in concrete (not in raceway).
2. Where insulated grounding conductors are used conductors shall be colored solid green.
3. Grounding electrode conductors #4 AWG and larger shall be installed in raceway.

C Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
3. Unless otherwise indicated, use double crimp compression connectors or exothermic welded connections for accessible connections.

D Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: As indicated elsewhere in this section.
3. Holes for Connections: All mechanical connectors shall be double hole double crimp compression connectors..

E Ground Rod Electrodes:
1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A Verify that work likely to damage grounding and bonding system components has been completed.
B Verify that field measurements are as indicated.
C Verify that conditions are satisfactory for installation prior to starting work.

**3.02 INSTALLATION**

A Install products in accordance with manufacturer's instructions.
B Install grounding and bonding system components in a neat and workmanlike manner.
C Boxes with concentric, eccentric or oversized knockouts shall be provided with bonding bushings and jumpers. The jumper shall be sized per NEC table 250-122 and lugged to the box.
D Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle.
1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.

E Make grounding and bonding connections using specified connectors.
1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.

4. Compression Connectors: Secure connections using manufacturer's recommended tools and dies. Connectors must be UL listed for use with grounding electrode conductors.

F Identify grounding and bonding system components in accordance with Section 26 05 53.

**3.03 FIELD QUALITY CONTROL**

A Inspect and test in accordance with NETA ATS Section 7.13.

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Verify that ground system was installed in accordance with the contract documents and NEC Article 250.
3. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
   a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter.
4. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal at ground test wells and at individual ground rods. Make tests at ground rods before any conductors are connected.
   a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
   b. Perform tests by fall-of-potential method according to IEEE 81.

B Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

C Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

D Submit detailed reports indicating inspection and testing results and corrective actions taken.

**END OF SECTION 26 05 26**

# SECTION 26 05 29
# HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

### 1.02 RELATED REQUIREMENTS

A Section 26 05 33.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

B Section 26 05 36 - Cable Trays for Electrical Systems: Additional support and attachment requirements for cable tray.

C Section 26 05 33.16 - Boxes and Cabinets: Additional support and attachment requirements for boxes.

### 1.03 REFERENCE STANDARDS

A NFPA 70 - National Electrical Code; National Fire Protection Association, Including All Applicable Amendments and Supplements; 2020.

### 1.04 ADMINISTRATIVE REQUIREMENTS

A Coordination:

B Sequencing:

### 1.05 SUBMITTALS

A Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

B Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

### 1.06 QUALITY ASSURANCE

### 1.07 DELIVERY, STORAGE, AND HANDLING

A Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

## PART 2 PRODUCTS

### 2.01 SUPPORT AND ATTACHMENT COMPONENTS

A General Requirements:

1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
4. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.

1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
2. Conduit Clamps: Bolted type unless otherwise indicated.

C Anchors and Fasteners:

1. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
2. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
3. Hollow Masonry: Use toggle bolts.
4. Hollow Stud Walls: Use toggle bolts.
5. Steel: Use beam clamps, machine bolts, or welded threaded studs.
6. Sheet Metal: Use sheet metal screws, bolts, or bolts.
7. Wood: Use wood screws.
8. Plastic and lead anchors are not permitted.
9. Powder-actuated fasteners are not permitted.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A Verify that field measurements are as indicated.

B Verify that mounting surfaces are ready to receive support and attachment components.

C Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 INSTALLATION

A Install products in accordance with manufacturer's instructions.

B Perform work in accordance with NECA 1 (general workmanship).

C Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D Do not provide support from suspended ceiling support system or ceiling grid.

E Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G Equipment Support and Attachment:

1. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H Conduits installed on the interior of exterior building walls shall be spaced off the wall surface a minimum of 1/4 inch using "clamp-backs" or strut.

I Remove temporary supports.

### 3.03 FIELD QUALITY CONTROL

A Inspect support and attachment components for damage and defects.

B Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C Correct deficiencies and replace damaged or defective support and attachment components.

**END OF SECTION 26 05 29**

# SECTION 26 05 33.13
# CONDUIT FOR ELECTRICAL SYSTEMS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Galvanized steel rigid metal conduit (RMC).
B Flexible metal conduit (FMC).
C Liquidtight flexible metal conduit (LFMC).
D Electrical metallic tubing (EMT).
E Rigid polyvinyl chloride (PVC) conduit.
F Conduit fittings.
G Accessories.

### 1.02 REFERENCE STANDARDS

A ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.
B ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.
C ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.
D ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.
E ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
F ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
G NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.
H NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2017.
I NFPA 70 - National Electrical Code; National Fire Protection Association, Including All Applicable Amendments and Supplements; 2020.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A Coordination:
1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B Sequencing:
1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

### 1.04 SUBMITTALS

A Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.
B Project Record Documents: Record actual routing for conduits installed underground exterior to the building envelope.

### 1.05 QUALITY ASSURANCE

A Conduit shall be delivered to the project site in bundles of full length pipes, each length marked with the trademark of the manufacturer and the Underwriters' Laboratories, Inc. stamp. Each conduit length shall be straight, true and free from scales, blisters, burrs and other imperfections.
1. Product Listing Organization Qualifications: Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label Electrical and Mechanical Equipment.

### 1.06 DELIVERY, STORAGE, AND HANDLING

A Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

**PART 2 PRODUCTS**

**2.01 CONDUIT APPLICATIONS**

A Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications.

C Embedded Within Concrete:
1. Within Slab on Grade: Not permitted.
2. Within Slab Above Ground: Not permitted.
3. Within Poured Concrete Walls Above Ground: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).

D Outdoors: Apply raceways as indicated below unless otherwise noted
1. Above ground conduit: Rigid galvanized steel conduit with 90 degree rigid elbow below grade transition to PVC.
2. Roof: Rigid galvanized steel conduit supported on rubber blocks and unistrut frame. Conduit must be at least 3-1/2" above roof surface.
3. Feeders: PVC Type DB concrete encased
4. Branch circuits: Schedule 40 PVC direct buried
5. Telecommunications: Schedule 40 PVC concrete encased
6. Connections to vibrating equipment including transformers, generators, and other motor driven equipment: Liquid tight flexible metal conduit.
7. Boxes and enclosures above ground Nema Type 4
8. Where rigid polyvinyl (PVC) conduit is used for feeder conductors, transition to galvanized steel rigid metal conduit a minimum of three feet horizontally prior to emerging from underground.
9. Where rigid polyvinyl (PVC) conduitis used for branch circuits, use galvanized steel rigid metal conduit elbows for bends.

E Indoors: Finished spaces (not subject to physical damage)
1. Raceway shall be routed concealed in interior portions of furred spaces, ceilings, and cavities, unless other than concrete or solid plaster where possible.
2. Raceways 2 inch or less shall be allowed to be EMT conduit.
3. All raceways concealed in exterior walls shall be rigid galvanized steel conduit.
4. All raceways larger than 2 inch shall be rigid galvanized conduit.
5. Where surface mounted conduit is required in finished spaces, contractor shall utilize surface metal raceway wire mold.
6. Where there is a transition between RGS in a wall to EMT above ceiling, it shall be made at a junction box above accessible ceiling.
7. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.

F Stub Ups
1. All feeder stub ups shall transition below grade from PVC to rigid a minimum of 3 feet horizontally from stub up location.
2. All branch circuit stub ups, where exposed or in non-CMU walls, shall transition to rigid galvanized steel at 90 degree elbow.
3. Schedule 40 rigid polyvinyl (PVC) stub ups are only allowed where conduits come up in CMU walls or the bottom of floor mounted equipment.

G Unfinished spaces subject to damage (Electrical, Mechanical etc.)
1. All conduit in unfinished spaces shall rigid galvanized steel. Conduit is not considered subject to damage when installed at least 10 feet above finished floor or tight to structure.
2. Conduits are not required to transition to transition to rigid galvanized steel where they are routed down into panelboards or other wall mounted equipment.

H Exposed, Interior finished spaces: Use surface metal raceway as identified on the drawings.
1. Surface metal raceway shall be manufactured by Wiremold or approved equal.

2. A separate equipment ground conductor shall be run in the surface metal raceway.

I Connection to vibrating equipment shall be made with flexible metal conduit or liquid tight flexible metal conduit depending on the environment installed.

J Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit shall be allowed.
1. Maximum Length: 6 feet.

K Connections to Vibrating Equipment:
1. Dry Locations: Use flexible metal conduit.
2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
3. Maximum Length: 6 feet unless otherwise indicated.
4. Vibrating equipment includes, but is not limited to:
   a. Transformers.
   b. Motors.

## 2.02 CONDUIT REQUIREMENTS

A Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.

B Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

C Provide products listed, classified, and labeled as suitable for the purpose intended.

D Minimum Conduit Size, Unless Otherwise Indicated:
1. Interior: 3/4 inch (21 mm) trade size.
2. Flexible Connections to Luminaires: 1/2 inch ( 13 mm) trade size.
3. Exterior: 1 inch (27 mm) trade size.

## 2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A Manufacturers:
1. Allied Tube & Conduit.
2. Republic Conduit.
3. Wheatland Tube Company.
4. or approved equal.

B Description: NFPA 70, Type RMC standard weight mild steel, hot dipped galvanized, sherardised or zinc-coated rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C Fittings:
1. Manufacturers:
   a. Thomas & Betts Corporation.
   b. Rayco.
   c. Appleton.
   d. or approved equal.
2. Connectors and Couplings: Use steel compression fittings with insulated throats.

## 2.04 INTERMEDIATE METAL CONDUIT (IMC)

A Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

B Fittings:
1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.
3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

## 2.05 FLEXIBLE METAL CONDUIT AND LIQUIDTIGHT FLEXIBLE METAL CONDUIT (FMC LFMC)

A Manufacturers:
1. Allied Tube & Conduit.
2. Republic Conduit.
3. Wheatland Tube Company.
4. or approved equal.

B Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

C Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

D Spiral strip construction shall allow the conduit to bend up to four times its internal radius.

E Fittings shall be compression type with insulated throats and listed for use with conduit specified.

**2.06 ELECTRICAL METALLIC TUBING (EMT)**

A Manufacturers:

1. Allied Tube & Conduit.
2. Republic Conduit.
3. Wheatland Tube Company.
4. or approved equal.

B Description: NFPA 70, Type EMT cold-rolled steel electrical metallic tubing with zinc coating on the inside and protected on the inside by a zinc, enamel or equivalent corrosion-resistant coating complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.
3. Connectors and Couplings: Use hexagonal compression (gland) type.
   a. Do not use indenter type connectors and couplings.
   b. Do not use set-screw type connectors and couplings.

**2.07 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT**

A Manufacturers:

1. Allied Tube & Conduit.
2. Republic Conduit.
3. Wheatland Tube Company.
4. or approved equal.

B Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 or Schedule 80 as indicated; rated for use with conductors rated 90 degrees C.

C Fittings:

1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

**2.08 ACCESSORIES**

A Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil.

B Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

C Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A Verify that field measurements are as indicated.

B Verify that mounting surfaces are ready to receive conduits.

C Verify that conditions are satisfactory for installation prior to starting work.

**3.02 INSTALLATION**

A Install products in accordance with manufacturer's instructions.

B Install conduit in a neat and workmanlike manner tight against walls, columns or ceilings.

C The conduit shall bend cold 90 degrees about a radius equal to ten (10) times its own diameter without signs of flaw or fracture in either pipe or protective coverings. All bends and offsets shall be made on a forming tool to prevent the conduit or its coating from being damaged in the bending.

D Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

E Install intermediate metal conduit (IMC) in accordance with NECA 101.

F Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.

G Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

H Conduit Routing:

1. Unless dimensioned, conduit routing indicated is diagrammatic.
2. Conceal all conduits unless specifically indicated to be exposed.
3. Conduits in the following areas may be exposed, unless otherwise indicated:
   a. Electrical rooms.
   b. Mechanical equipment rooms.
4. Arrange conduit to maintain maximum headroom, clearances, and access.
5. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
6. Arrange conduit to provide no more than 100 feet between pull points.
7. In every instance, conduit shall be installed in such a manner that the conductors may readily and easily be drawn or pulled in without strain or damage to the insulation; and, also, so that defective conductors may be readily and easily withdrawn and replaced by new conductors. Long radius bends and a sufficient number of approved pull and junction boxes shall be approved for this purpose, and as may be directed by the Engineer. All conduit shall be securely supported and grounded.
8. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
9. Where conduits join any couplings or threaded fittings, the ends shall be made watertight.
10. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:

I Conduit Support:

1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
2. Secure and support conduits in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
3. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
4. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
5. Use conduit strap to support single surface-mounted conduit.
   a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
6. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
7. Use conduit clamp to support single conduit from beam clamp or threaded rod.
8. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
9. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
   a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
   b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
   c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
   d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
10. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
    a. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch.
    b. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.

J Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
5. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
6. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
7. Condulet fittings shall not be used in lieu of pull boxes.

K Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
   a. All raceway penetrating exterior walls or other water proof membranes shall slope away from the building with a minimum slope of 4" over 100 feet.
4. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as required to preserve integrity of roofing system and maintain roof warranty.
5. Install firestopping to preserve fire resistance rating of partitions and other elements. Refer to penetration details on plans.
6. Where conduits cross building expansion joints or pass between areas with a temperature difference of 14 degrees C, provide expansion fittings on all raceway.

L Underground Installation:
1. Minimum Cover, Unless Otherwise Indicated or Required:
   a. Underground, Exterior: 24 inches.
2. Provide underground warning tape six to eight inches below finished grade directly above raceway. Tape shall be six inches wide with a minimum thickness of seven mil, non-distorting, colorfast, no-stretch, 600 pound tensile strength per six inch width, ultraviolet light fast. Message must repeat within a maximum of 40 inches. Painted legend shall be indicative of the type of underground line.

M Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 03 30 00 with minimum concrete cover of 3 inches on all sides unless otherwise indicated.

N Ductbanks containing conductors of 600 volts or more shall be concrete encased with red dyed concrete.

O Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where conduits are subject to earth movement by settlement or frost.

P Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
3. Where conduits penetrate coolers or freezers.

Q Provide 200 pound tensile strength pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end. All empty conduits shall terminate in a junction box.

R All ducts shall be sealed at terminations, using sealing compound and plugs, as required to withstand 15 psi minimum hydrostatic pressure.

**3.03 FIELD QUALITY CONTROL**

A Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

B Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

C Correct deficiencies and replace damaged or defective conduits.

**3.04 CLEANING**

A Clean interior of conduits to remove moisture and foreign matter.

**3.05 PROTECTION**

A Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

**END OF SECTION 26 05 33.13**

# SECTION 26 05 33.16
# BOXES AND CABINETS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

### 1.02 REFERENCE STANDARDS

A NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

B NFPA 70 - National Electrical Code; National Fire Protection Association, Including All Applicable Amendments and Supplements; 2020.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

### 1.04 SUBMITTALS

A Product Data: Provide manufacturer's standard catalog pages and data sheets for outlet and device boxes, junction and pull boxes, cabinets and enclosures, and floor boxes.

B Project Record Documents: Record actual locations for outlet and device boxes, cabinets and enclosures, and floor boxes.

### 1.05 QUALITY ASSURANCE

A Product Listing Organization Qualifications: Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label Electrical and Mechanical Equipment.

### 1.06 DELIVERY, STORAGE, AND HANDLING

A Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

## PART 2 PRODUCTS

### 2.01 BOXES

A General Requirements:

1. The Electrical Contractor shall provide junction boxes, pull boxes, cable, support boxes, and wiring troughs as required by NEC and as otherwise indicated in the Drawings.
2. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
3. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
4. Provide products listed, classified, and labeled as suitable for the purpose intended.
5. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
6. Provide grounding terminals within boxes where equipment grounding conductors terminate.
7. Each outlet designated on the plans shall be provided with an outlet box.

8. In general, outlets shall be installed at the heights indicated. The Contractor shall examine the plans of and coordinate with all other trades to assure mounting heights are correct for the intended purpose. Assure that all mounting heights comply with the latest version of ADA. Outlets installed at incorrect heights shall be relocated to the correct elevation at the Contractor's expense.

B Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:

1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Outlet boxes shall be 4" square, 2 1/8" deep unless otherwise noted.
4. Use suitable concrete type boxes where flush-mounted in concrete.
5. Use suitable masonry type boxes where flush-mounted in masonry walls.
6. Do not use "through-wall" boxes designed for access from both sides of wall.
7. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
8. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
9. Junction boxes larger than 4" square shall be galvanized and without pre-formed knockouts.
10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
12. Manufacturers Recessed:
    a. Steel City Electric Company
    b. Metropolitan
    c. B & C
    d. or approved equal.
13. Manufacturers Surface:
    a. Crouse-Hinds
    b. Appleton
    c. Rayco
    d. or approved equal.

C Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:

1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
3. Junction and Pull Boxes Larger Than 100 cubic inches:
    a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
    b. Boxes 12" square and Larger: Provide hinged-cover enclosures with quick access latches.
4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
    a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
5. Manufacturers Surface:
    a. Cooper.
    b. Hoffman.
    c. Hubbell Incorporated.
    d. or approved equal..

## PART 3 EXECUTION

### 3.01 EXAMINATION

A Verify that field measurements are as indicated.

B Verify that mounting surfaces are ready to receive boxes.

C Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 INSTALLATION

A Install products in accordance with manufacturer's instructions.

B Perform work in a neat and workmanlike manner.

C Arrange equipment to provide maximum clearances.

D Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

E Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

F Box Locations:

1. Locate boxes in accessible locations.
2. Locate boxes so that wall plates do not span different building finishes.
3. Locate boxes so that wall plates do not cross masonry joints.
4. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
5. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
6. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.

G Box Supports:

1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.

H Install boxes plumb and level.

I Flush-Mounted Boxes:

1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

J Install boxes as required to preserve insulation integrity.

K Boxes in damp or wet locations shall be provided with gaskets and covers.

L Install permanent barrier between ganged wiring devices when voltage difference between adjacent devices exceeds 300 V.

M Close unused box openings.

N Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

**3.03 CLEANING**

A Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

**3.04 PROTECTION**

A Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

**END OF SECTION 26 05 33.16**

# SECTION 26 05 53
# IDENTIFICATION FOR ELECTRICAL SYSTEMS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Electrical identification requirements.
B Identification nameplates and labels.
C Wire and cable markers.
D Underground warning tape.
E Warning signs and labels.

### 1.02 REFERENCE STANDARDS

A ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011 (Reaffirmed 2017).
B ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011 (Reaffirmed 2017).
C NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
D UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A Coordination:
1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B Sequencing:
1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
2. Do not install identification products until final surface finishes and painting are complete.

### 1.04 SUBMITTALS

A Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
B Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

### 1.05 FIELD CONDITIONS

A Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

## PART 2 PRODUCTS

### 2.01 IDENTIFICATION REQUIREMENTS

A Identification for Equipment:
1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
a. Distribution Panelboard Service Entrance:
1) Identify ampere rating.
2) Identify voltage and phase.
3) Identify power source and circuit number. Include location.
4) Use identification nameplate to identify main overcurrent protective device.
5) Use identification nameplate to identify load(s) served for each branch devicewhere not identified in a panelboard schedule.
6) Provide Maximum Fault Current Placard as per NEC 110.24.
b. Panelboards:
1) Identify ampere rating.
2) Identify voltage and phase.
3) Identify power source and circuit number. Include location.
4) Use typewritten circuit directory to identify load(s) served.
c. Enclosed switches, circuit breakers, and motor controllers:
1) Identify voltage and phase.
2) Identify power source and circuit number. Include location.
3) Identify load(s) served. Include location.

d. Enclosed Contactors:
   1) Identify ampere rating.
   2) Identify voltage and phase.
   3) Identify coil voltage.
   4) Identify load(s) and associated circuits controlled. Include location.

2. Service Equipment:
   a. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.
3. Emergency System Equipment:
   a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
4. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
5. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
   a. Service equipment.
6. Arc Flash Hazard Warning Labels: Comply with Section 26 05 73.

B Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
2. Identification for Communications Conductors and Cables: Comply with Section 27 10 00.
3. Use underground warning tape to identify power and communication feeders and branch circuits exterior to the building.

C Identification for Boxes:
1. Use color coded boxes to identify specified systems.
   a. Color-Coded Boxes: Field-painted per the same color coding as identified in this section for the system contained within.
   b. Fire alarm junction boxes shall be painted on all sides including the box cover.
2. For boxes concealed above accessible ceilings or exposed in mechanical or electrical rooms use neatly handwritten text using indelible marker to identify circuits enclosed.
3. For exposed boxes in public areas, use only type written labels.

D Identification for Devices:
1. Wiring Device and Wallplate Finishes: Comply with Section 26 27 26.
2. Use identification label to identify fire alarm system devices.
3. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
4. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.

E Color Coding
1. Phenolic Nameplates and associated conduit and boxes shall be identified with the following color scheme. Note: For existing buildings the contractor shall field verify the existing building standard and revise the color scheme to match the existing field conditions. Failure to match existing conditions will result in the contractor correcting the mislabeled equipment at his expense.
   a. Blue surface white core - 120/208V equipment.
   b. Bright red surface white core - fire alarm equipment.
   c. Dark red (burgundy) surface white core - security equipment.
   d. Green surface white core - emergency systems.
   e. Orange surface white core - telephone systems.
   f. Brown surface white core - data systems.
   g. White surface black core - paging systems.
   h. Purple surface white core - TV systems.

**2.02 IDENTIFICATION NAMEPLATES AND LABELS**

A Identification Nameplates:
1. Materials:
   a. Indoor Clean, Dry Locations: Use plastic nameplates.
   b. Outdoor Locations: Use plastic nameplates suitable for exterior use.
2. Plastic Nameplates: Two-layer or three-layer laminated electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
3. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.
4. Nameplates shall be secured with self tapping stainless steel screws; if screws have sharp ends they shall be protected, otherwise rivets shall be used.

B Identification Labels:
1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
   a. Use only for indoor locations.
2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text.

C Format for Equipment Identification:
1. Minimum Size: 1 inch by 2.5 inches.
2. Text: All capitalized unless otherwise indicated.
3. Minimum Text Height:
   a. Equipment Designation: 1/2 inch.
   b. Exception: Provide minimum text height of 1 inch for equipment located more than 10 feet above floor or working platform.

D Wiring device circuit labels.
1. All wiring devices (receptacles and switches) shall be labeled with the circuit serving the device. Label shall be a typed adhesive label affixed to the front of the wiring device face plate. Label shall have black text on clear background.

**2.03 UNDERGROUND WARNING TAPE**

A Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 7 mil, unless otherwise required for proper detection.

B Legend: Type of service, continuously repeated over full length of tape.

C Color:
1. Tape for Buried Power Lines: Black text on red background.
2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

**2.04 WARNING SIGNS AND LABELS**

A Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B Warning Signs:
1. Materials:
   a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
   b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.

C Warning Labels:
1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.

**PART 3 EXECUTION**

**3.01 PREPARATION**

A Clean surfaces to receive adhesive products according to manufacturer's instructions.

**3.02 INSTALLATION**

A Install products in accordance with manufacturer's instructions.

B Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance.

C Install identification products centered, level, and parallel with lines of item being identified.

D Secure nameplates to exterior surfaces of enclosures using stainless steel screws.

E Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F Install underground warning tape above buried lines with one tape per trench at six to eight inches below finished grade.

G Secure rigid signs using stainless steel screws.

H Mark all handwritten text, where permitted, to be neat and legible.

**3.03 FIELD QUALITY CONTROL**

A Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

**END OF SECTION 26 05 53**

# SECTION 26 05 70
# ELECTRICAL COORDINATION DRAWINGS

## 1.01 SECTION INCLUDES

A The Electrical Contractor shall be responsible for providing 1/4 scale drawings to the Mechanical Contractor, in REVIT, for the entire project.

B The drawings shall cover above ceiling spaces, mechanical rooms, electrical rooms, and service yards.

## PART 2 PRODUCT - NOT USED

## PART 3 EXECUTION

## 3.01 COORDINATION (REVIT)

A The Electrical contractor shall obtain architectural base plans from the architect. The drawings will be Revit **2018** or higher.

B The drawing files shall be forwarded to the mechanical contractor for incorporation into the overall coordination drawings.

C The Electrical contractor shall be responsible for coordinating any conflicts with the mechanical contractor and fire protection contractor. In addition, the electrical contractor is responsible for attending any required coordination meetings at the job site.

D The final overall coordination drawings must be completed prior to any fire protection, mechanical and electrical work starting on the job.

E The Electrical Contractor is responsible for purchasing his final overall coordination drawings from the printer.

**END OF SECTION 26 05 70 26 05 70**

# SECTION 26 05 73
# POWER SYSTEM STUDIES

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Short-circuit study.

B Protective device coordination study.

C Arc flash and shock risk assessment.

1. Includes arc flash hazard warning labels.

D Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

### 1.02 REFERENCE STANDARDS

A IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations; 2018, with Errata (2019).

B NFPA 70 - National Electrical Code; National Fire Protection Association, Including All Applicable Amendments and Supplements; 2020.

C NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A Coordination:

1. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
2. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B Sequencing:

1. Submit study reports prior to or concurrent with product submittals.
2. Contractor shall be responsible for making any and all changes to the purchased equipment as recommended in the study results. Changes to the electrical distribution equipment, generator, transfer switches, and breakers due to study recommendations and to comply with the requirements of this section shall not incur an additional cost to the project. This includes but is not limited to changes in equipment or breakers to meet required maximum fault current levels, changes in breaker models, types or frame sizes to achieve selective coordination where required, changes in breaker models or types to achieve the required minimum AIC rating for transfer switches.
3. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.
4. Verify naming convention for equipment identification prior to creation of final drawings, reports, and arc flash hazard warning labels to match equipment name plates.
5. Study shall be updated prior to project completion. All changes throughout construction shall be incorporated in the update.
6. After study has been updated with construction changes, print and apply labels.
7. Final study shall be included in the O&M manuals.

### 1.04 SUBMITTALS

A Study preparer's qualifications.

B Study reports, stamped or sealed and signed by study preparer.

C Product Data:

1. Include characteristic time-current trip curves for protective devices.
2. Clearly indicate short circuit current ratings for all equipment. Series rating is not allowed.

D All submittals transmitted to the engineer for approval shall have a digital copy of the report and model files included on a USB drive.

E Arc Flash Hazard Warning Label Samples: One of each type required. All labels shall be rated to withstand the environment where installed.

F Certification that field adjustable protective devices have been set in accordance with requirements of studies.

G Project Record Documents: Revise studies as required to reflect as-built conditions.

1. Include hard copies with operation and maintenance data submittals.

2. Include computer software files used to prepare studies with file name(s) cross-referenced to specific pieces of equipment and systems.

**1.05 POWER SYSTEM STUDIES**

A Scope of Studies:
1. Perform analysis of new electrical distribution system as indicated on drawings.
2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.
   a. Known Operating Modes:
      1) Utility as source.

B General Study Requirements:
1. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.

C Data Collection:
1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
   a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
      1) Obtain up-to-date information from Utility Company.
      2) Include in the report documentation the following information
         (a) Utility Company: Contractor to Determine.
            (1) Point of Contact: Contractor to Determine.
            (2) Address: Contractor to Determine.
            (3) Phone: Contractor to Determine.
            (4) Email: Contractor to Determine.
            (5) Utility Company Project Reference Number: Contractor to Determine.
            (6) Date Fault Current was obtained from power company.
   b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.
   c. Motors 25HP and greater: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, and full load amps.
   d. Branch circuit and overcurrent protective device information associated with all industrial control panels, including HVAC control panels.
   e. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
   f. Protective Devices:
      1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).
      2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).
   g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.
   h. Contractor shall maintain a log of all conductor sizes and lengths to be used in the power systems study.

D Short-Circuit Study:
1. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:
   a. Maximum utility fault currents.
   b. Maximum motor contribution.

2. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.
3. Calculate the short circuit current at the following additional locations:
   a. Elevator Controllers.
   b. Industrial Control Panels, including HVAC control panels.
   c. Motor Control Centers.

E Protective Device Coordination Study:
1. Analyze alternate scenarios considering known operating modes (e.g. utility as source, generator as source).
2. Analyze protective devices on the normal power system and associated settings for suitable margins between time-current curves to achieve best possible coordination while providing adequate protection for equipment and conductors.
3. For emergency systems analyze protective devices and associated settings so that full selective coordination is achieved per NEC 700.27

F Arc Flash and Shock Risk Assessment:
1. Comply with NFPA 70E.
2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.
3. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
   a. Maximum and minimum utility fault currents.
   b. Maximum and minimum motor contribution.
   c. Known operating modes (e.g. utility as source, generator as source).

G Study Reports:
1. General Requirements:
   a. Identify date of study and study preparer.
   b. Identify study methodology and software product(s) used.
   c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
   d. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
   e. Include conclusions and recommendations.
2. Short-Circuit Study:
   a. For each scenario, identify at each bus location:
      1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
      2) Fault point X/R ratio.
      3) Associated equipment short circuit current ratings.
   b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.
3. Protective Device Coordination Study:
   a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.
   b. For each graph include (where applicable):
      1) Partial single-line diagram identifying the portion of the system illustrated.
      2) Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the source, plotted up to the maximum available fault current at the associated bus.
      3) Transformers: Inrush points and damage curves.
      4) Generators: Full load current, overload curves, decrement curves, and short circuit withstand points.
      5) Motors: Full load current, starting curves, and damage curves.

c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.
   1) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.
   2) Include ground fault pickup and delay.
   3) Include fuse ratings.

d. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.

4. Arc Flash and Shock Risk Assessment:
   a. For the worst case for each scenario, identify at each bus location:
      1) Calculated incident energy and associated working distance.
      2) Calculated arc flash boundary.
      3) Bolted fault current.
      4) Arcing fault current.
      5) Clearing time.
      6) Arc gap distance.
   b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.
   c. Include recommendations for reducing the incident energy at locations where the calculated maximum incident energy exceeds 8 calories per sq cm.
5. For Oneline diagram indicate the following:
   a. At each Bus:
      1) Equipment ID.
      2) Voltage.
      3) 3 Phase Fault Current.
      4) 1 Phase Fault Current.
      5) X/R ratio.
   b. At each breaker:
      1) Equipment ID.
      2) Device Amperage.
      3) Voltage Rating.
      4) Interrupting Rating.
      5) Breaker Settings (If applicable).
   c. At each source:
      1) Device ID.
      2) Voltage.
      3) 3 Phase Fault Current.
      4) 1 Phase Fault Current.
      5) X/R Rating.
   d. At each Generator:
      1) Equipment ID.
      2) Rated kW.
      3) Rated kVA.
      4) Voltage.
   e. At each Transformer:
      1) Equipment ID.
      2) Rated kVA.
      3) Primary Voltage.
      4) Secondary Voltage.
      5) Percent Impedance.
   f. At each Motor:

1) Equipment ID.
2) Rated Horse Power.

**1.06 QUALITY ASSURANCE**

A Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum three years experience in the preparation of studies of similar type and complexity using specified computer software.
1. Study preparer may be employed by the manufacturer of the electrical distribution equipment.

B Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.
1. Acceptable Software Products:
   a. EasyPower LLC: www.easypower.com/#sle.
   b. ETAP/Operation Technology, Inc: www.etap.com/#sle.
   c. SKM Systems Analysis, Inc: www.skm.com/#sle.

**PART 2 PRODUCTS**

**2.01 ARC FLASH HAZARD WARNING LABELS**

A Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.
1. Materials: Label shall be vinyl adhesive with moisture and UV resistance. Paper adhesive labels will not be accepted.
2. Label Information shall comply with 2015 NFPA 70E.
3. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
   a. Include at least the following information:
      1) Arc flash boundary.
      2) Available incident energy and corresponding working distance.
      3) Site-specific PPE (personnel protective equipment) requirements.
      4) Nominal system voltage.
      5) Limited approach boundary.
      6) Restricted approach boundary.
      7) Equipment identification.
      8) Date calculations were performed.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A Labels shall be cut with straight and perpendicular lines.

B Labels shall be installed neatly and consistently from one piece of equipment to another.

C Clean surface of equipment so that it is free of dirt, dust, or other foreign substance prior to applying labels.

**3.02 FIELD QUALITY CONTROL**

A Adjust equipment and protective devices for compliance with studies and recommended settings.

**END OF SECTION 26 05 73**

# SECTION 26 09 23
# LIGHTING CONTROL DEVICES

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Occupancy sensors.
B Lighting contactors.
C Accessories.

### 1.02 REFERENCE STANDARDS

A NFPA 70 - National Electrical Code; National Fire Protection Association, Including All Applicable Amendments and Supplements; 2020.
B NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).
C NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; 2017.
D NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (Reaffirmed 2016).
E UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules; Current Edition, Including All Revisions.
F UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters; Current Edition, Including All Revisions.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A Coordination:
1. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
2. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
3. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B Sequencing:
1. Do not install lighting control devices until final surface finishes and painting are complete.

### 1.04 SUBMITTALS

A Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

B Shop Drawings:
1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.

C Field Quality Control Reports.
D Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
E Operation and Maintenance Data: Include detailed information on device programming and setup.
F Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
G Project Record Documents: Record actual installed locations and settings for lighting control devices.

### 1.05 QUALITY ASSURANCE

A Comply with requirements of NFPA 70.
B Maintain at the project site a copy of each referenced document that prescribes execution requirements.
C Product Listing Organization Qualifications: Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label Electrical and Mechanical Equipment.

### 1.06 DELIVERY, STORAGE, AND PROTECTION

A Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

### 1.07 FIELD CONDITIONS

A Maintain field conditions within manufacturer's required service conditions during and after installation.

**1.08 WARRANTY**

A Provide five year manufacturer warranty for all occupancy sensors.

**PART 2 PRODUCTS**

**2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS**

A Provide products listed, classified, and labeled as suitable for the purpose intended.

B Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

**2.02 OCCUPANCY SENSORS**

A Manufacturers:

1. Hubbell Incorporated: www.hubbell.com/#sle.
2. Leviton.
3. WattStopper.
4. Approved Equal.
5. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B All Occupancy Sensors:

1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
2. Sensor Technology:
   a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
   b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
   c. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
3. Provide LED to visually indicate motion detection.
4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
7. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
8. Sensitivity: Field adjustable.
9. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
10. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, for interface with HVAC systems.

C Wall Switch Occupancy Sensors:

1. All Wall Switch Occupancy Sensors:
   a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
   b. Unless otherwise indicated or required to control the load indicated on drawings, provide line voltage units with self-contained relay.
   c. Finish: Match finishes specified for wiring devices in Section 26 27 26, unless otherwise indicated.
2. Dual Technology wall switch occupancy sensors: Capable of detecting motion within an area of 35 x 30 foot area for major motion and a 20 x 15 foot area for minor motion.
   a. Products:

1) Single Button: Wattstopper DW-100.
2) Two Button: Wattstopper DW-200.
3) or approved equal.

D Ceiling Mounted Occupancy Sensors:
1. All Ceiling Mounted Occupancy Sensors:
   a. Description: Low profile occupancy sensors designed for ceiling installation.
   b. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
   c. Provide field selectable setting for disabling LED motion detector visual indicator.
   d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
   e. Finish: White unless otherwise indicated.
2. Passive Infrared (PIR) Ceiling Mounted Occupancy Sensors:
   a. Standard Range Sensors: Capable of detecting motion within an area of 500 square feet coverage at a mounting height of 8 feet, with a field of view of 360 degrees.
      1) Products:
         (a) Wattstopper CI-200-1.
         (b) Approved Equal.
   b. Extended Range Sensors: Capable of detecting motion within an area of 2,000 square feet coverage at a mounting height of 15 feet, with a field of view of 360 degrees.
      1) Products:
         (a) Wattstopper CX-100.
         (b) or approved equal.
3. Ultrasonic Ceiling Mounted Occupancy Sensors:
   a. Extended Range Sensors: Capable of detecting motion within an area of 1,100 square feet coverage at a mounting height of 12 feet, with a field of view of 360 degrees.
      1) Products:
         (a) Room Sensors: Wattstopper WT1100.
         (b) Corridor Sensor with 90 linear feet of coverage Wattstopper WT 2250.
         (c) or approved equal.
4. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
   a. Extended Range Sensors: Capable of detecting motion within an area of 1,000 square feet coverage 9 feet, with a field of view of 360 degrees.
      1) Products:
         (a) Wattstopper DT-300.

E Directional Occupancy Sensors:
1. All Directional Occupancy Sensors: Designed for wall or ceiling mounting, with integral swivel for field adjustment of motion detection coverage.
   a. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
   b. Provide field selectable setting for disabling LED motion detector visual indicator.
   c. Finish: White unless otherwise indicated.
2. Passive Infrared (PIR) Directional Occupancy Sensors:
3. Passive Infrared/Ultrasonic Dual Technology Directional Occupancy Sensors: Capable of detecting motion within a distance of 40 feet at a mounting height of 10 feet.
   a. Products:
      1) Wattstopper CX-100.
      2) Wattstopper DT-200.
      3) or approved equal.

F Power Packs for Low Voltage Occupancy Sensors:
1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.

2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
3. Input Supply Voltage: Dual rated for 120/277 V ac.
4. Power packs shall be capable of fitting in a standard 4" square junction box.
5. Load Rating: As required to control the load indicated on drawings.
6. Provide isolated relay for interface with HVAC units.

**2.03 LIGHTING CONTACTORS**

A Manufacturers:
1. ABB/GE: www.geindustrial.com/#sle.
2. Eaton Corporation: www.eaton.com/#sle.
3. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

B Description: Magnetic lighting contactors complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; noncombination type unless otherwise indicated; ratings, configurations and features as indicated on the drawings.

C Short Circuit Current Rating:
1. Provide contactors with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.

D Enclosures:
1. Comply with NEMA ICS 6.
2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
3. Finish: Manufacturer's standard unless otherwise indicated.

**2.04 ACCESSORIES**

A Auxiliary Contacts:
1. Comply with NEMA ICS 5.
2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each lighting contactor, minimum.

B Pilot Devices:
1. Comply with NEMA ICS 5; heavy-duty type.
2. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.
3. Indicating Lights: Push-to-test type unless otherwise indicated.

**2.05 LIGHTING OVERRIDE SWITCHES AND BAS PROGRAMMING**

A Coordinate all override lighting controls, contactors, and programming with the BAS controls contractor.

B BAS controls contractor shall provide single button override switches with all associated wiring back to BAS panel. Electrical contractor shall provide device box, and 3/4" conduit, with pull string, to above nearest accessible ceiling.

C BAS system will have all required outputs to control the lighting contactors identified on the drawings.

D Override switches shall be programmed by BAS controls contractor as follows:
1. Time of day schedule shall be coordinated with owner.
2. During scheduled on period: button press has no effect.
3. Impending off event: Fifteen minutes prior to a scheduled off event BAS shall blink the lights on and off three times in three second intervals to warn occupants.
4. If button is pressed during an impending off event the normal schedule shall be overridden to be on for two hours from the time the button is pressed.
5. 15 minutes prior to the 2 hour override is expired if the normal schedule is still off another impending off blink warning will be initiated.
6. Pressing the button at any time during a normally scheduled off period will initiate a 2 hour on override.

E Exterior Lighting Controls Programming.
1. Exterior lighting schedule shall be confirmed with owner prior to programming.

2. On/Off schedule shall be adjustable based on daylight sensor input to turn exterior lighting on/off based on exterior lighting levels.
3. In general exterior lighting shall turn on 15 minutes prior to sunset, off at 12:00am, and on again at 5:00 am until sunrise. Coordinate final sequence with owner.

F Upon activation of fire alarm system the BAS shall automatically override any schedule off period or event. Normal programmed schedule to resume once fire alarm system is no longer in alarm.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A Verify that field measurements are as indicated.

B Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D Verify that final surface finishes are complete, including painting.

E Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

G Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 PREPARATION

A Provide extension rings to bring outlet boxes flush with finished surface.

B Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

### 3.03 INSTALLATION

A Perform work in a neat and workmanlike manner in accordance.

B Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of lighting control devices provided under this section.

1. Mounting Heights: Unless otherwise indicated, as follows:
   a. Wall Switch Occupancy Sensors: 48 inches above finished floor.
2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.

C Install lighting control devices in accordance with manufacturer's instructions.

D Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

E Install lighting control devices plumb and level, and held securely in place.

F Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 27 26.

G Provide required supports in accordance with Section 26 05 29.

H Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings.

I Occupancy Sensor Locations:

1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.
2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 6 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

J Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling near the sensor location.

K Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.

### 3.04 FIELD QUALITY CONTROL

A Provide System Commissioning in accordance with 2018 NCECC Section C408.

B Inspect each lighting control device for damage and defects.

C Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area.

D Correct wiring deficiencies and replace damaged or defective lighting control devices.

**3.05 ADJUSTING**

A Adjust devices and wall plates to be flush and level.

B Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.

D Where indicated or as directed by Architect or owner, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

E Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Architect.

**3.06 CLEANING**

A Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

**3.07 CLOSEOUT ACTIVITIES**

A Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.

B Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.
3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed lighting control devices.
4. Location: At project site.

**END OF SECTION 26 09 23**

# SECTION 26 24 16
# PANELBOARDS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Power distribution panelboards.

B Lighting and appliance panelboards.

C Overcurrent protective devices for panelboards.

### 1.02 REFERENCE STANDARDS

A UL 67 - Panelboards; Current Edition, Including All Revisions.

B UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

C NFPA 70 - National Electrical Code; National Fire Protection Association, Including All Applicable Amendments and Supplements; 2020.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

### 1.04 SUBMITTALS

A Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

1. Contractor shall confirm that all lug sizes and quantities submitted are compatible with the conductors specified on the contract documents. Changes required to lug sizes and quantities due to lack of coordination between the contractor and the supplier are to be made at the contractor's expense.

B Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. It is the contractor's responsibility to ensure that the equipment submitted to comply with the requirements of this section are in compliance with the requirements and recommendations of the power system studies. Any changes recommended by the power system study shall be incorporated at no expense to the project.

C Field Quality Control Test Reports.

D Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

F Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

### 1.05 QUALITY ASSURANCE

A Comply with requirements of NFPA 70.

B Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C Product Listing Organization Qualifications: Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label Electrical and Mechanical Equipment.

D Contractor shall schedule a pre-energization site visit with the Engineer. Meeting shall be scheduled at least 7 days in advance. The results of the megger test and service ground resistance test shall be made available to the Engineer prior to scheduling the pre-energization site visit.

**1.06 DELIVERY, STORAGE, AND HANDLING**

A Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions.

B Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

**1.07 FIELD CONDITIONS**

A Maintain ambient temperature within the following limits during and after installation of panelboards:

1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

A ABB/GE: www.geindustrial.com/#sle.

B Eaton Corporation.

C Schneider Electric; Square D Products.

D Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

**2.02 PANELBOARDS - GENERAL REQUIREMENTS**

A Provide products listed, classified, and labeled as suitable for the purpose intended.

B Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet.
2. Ambient Temperature:
   a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

C Short Circuit Current Rating:

1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
2. When a power system study is included in the contract short circuit current ratings shall be verified with the study prior to submitting equipment for approval. Any changes required to meet the maximum available fault current shall be made in the submittal.
3. Series rating is not allowed.

D Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

E Service Entrance Panelboards shall have Main Circuit Breaker 100% fully rated.

F Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

G Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

H Bussing: Sized in accordance with UL 67 temperature rise requirements.

1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

I Conductor Terminations: Suitable for use with the conductors to be installed.

J Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: As indicated on the drawings.
2. Boxes: Galvanized steel unless otherwise indicated.
3. Fronts:
   a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
   b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
   c. All covers shall be door in door type where one door can be opened to access the breakers and and dead front and the second door opens to the wire bending space adjacent to the dead front.

d. Door in door covers shall feature a full length piano hinge.

4. Lockable Doors: All locks keyed alike unless otherwise indicated.

K Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

L Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

M Load centers are not acceptable.

**2.03 POWER DISTRIBUTION PANELBOARDS**

A Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B Conductor Terminations:

1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
2. Main and Neutral Lug Type: Compression.

C Bussing:

1. Phase and Neutral Bus Material: Copper.
2. Ground Bus Material: Copper.

D Circuit Breakers:

1. Provide bolt-on type.
2. Provide thermal magnetic circuit breakers for circuit breaker frame sizes less than 250 amperes.
3. Provide electronic trip circuit breakers for circuit breaker frame sizes 250 amperes and above.

E Enclosures:

1. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
2. Provide clear plastic circuit directory holder mounted on inside of door.

**2.04 LIGHTING AND APPLIANCE PANELBOARDS**

A Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B Conductor Terminations:

1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
2. Main and Neutral Lug Type: Compression.

C Bussing:

1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
2. Phase and Neutral Bus Material: Copper.
3. Ground Bus Material: Copper.

D Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E Provide electronic trip circuit breakers for circuit breaker frame sizes [250] amperes and above.

F Enclosures:

1. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
2. Provide clear plastic circuit directory holder mounted on inside of door.

**2.05 OVERCURRENT PROTECTIVE DEVICES**

A Main Breaker for Service Entrance Equipment shall be 100% Fully Rated!

B Molded Case Circuit Breakers:

1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:

a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated.
b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

3. Conductor Terminations:
   a. Provide compression lugs.
   b. Lug Material: Copper, suitable for terminating copper conductors only.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
   a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 100 amperes and larger.
5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
6. Provide electronic trip circuit breakers for circuit breaker frame sizes larger than 250 amperes.
   a. Provide the following individually field-adjustable trip response settings:
      1) Long time pickup, adjustable by setting dial.
      2) Long time delay.
      3) Short time pickup and delay.
      4) Instantaneous pickup.
      5) Ground fault pickup and delay where ground fault protection is indicated.
7. Do not use handle ties in lieu of multi-pole circuit breakers.
8. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
9. Provide the following features and accessories where indicated or where required to complete installation:
   a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
   b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.
      1) Provide handle locks for all breakers serving fire alarm equipment or elevator emergency communication systems. Handle locks shall be Space Age Electronics ELOCK series or approved equal.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A Verify that field measurements are as indicated.
B Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
C Verify that mounting surfaces are ready to receive panelboards.
D Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 INSTALLATION

A Perform work in accordance with NECA 1 (general workmanship).
B Install products in accordance with manufacturer's instructions.
C Install panelboards securely, in a neat and workmanlike manner.
D Arrange equipment to provide at least clearances in accordance with manufacturer's instructions and NFPA 70.
E Provide required support and attachment in accordance with Section 26 05 29.
F Install panelboards plumb.
G Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.
H Provide grounding and bonding in accordance with Section 26 05 26.
I Install all field-installed branch devices, components, and accessories.
J Set field-adjustable circuit breaker tripping function settings as directed. If a power system study is included in the contract, set breakers according to the recommendations made in the study.
K Provide filler plates to cover unused spaces in panelboards.

L Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
1. Emergency and night lighting circuits.
2. Fire detection and alarm circuits.

M Identify panelboards in accordance with Section 26 05 53.

**3.03 FIELD QUALITY CONTROL**

A Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 600 amperes. Tests listed as optional are not required.
1. Verify equipment nameplate is in accorance with contract documents.
2. Inspect physical and mechanical condition.
3. Inspect anchorage and anlignment.
4. Verify unit is clean.
5. Operate breaker to enusre smooth operation.
6. Perform breaker adjustamants in accorance with the power system study.
7. Perform resistance measurements through bolted connectionswith a low-resistance ohmmeter.
8. Perform insulation-resistance test for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed.
9. Perform contact/pole resistance test.
10. Determine long-time and short time pickup and delay settings by primary current injection.
11. Determine ground fault pickup and time delay by primary current injection.

B Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

C Test GFCI circuit breakers to verify proper operation.

D Test shunt trips to verify proper operation.

E Correct deficiencies and replace damaged or defective panelboards or associated components.

F For Services and feeders 1000 amperes and larger, and any installation utilizing selective coordination, the following test should be performed on the circuit breakers. Testing shall be performed by a qualified manufacturer's factory technician at the job site. All readings shall be tabulated.
1. Phase Tripping tolerance (within 20% of UL requirements).
2. Trip time (per phase) in seconds.
3. Instantaneous trip (amps) per phase.
4. Insulation resistance (in megohms) at 1000-volts DC (phase to phase, and line to load).

**3.04 ADJUSTING**

A Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B Adjust alignment of panelboard fronts.

C Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

**3.05 CLEANING**

A Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B Repair scratched or marred exterior surfaces to match original factory finish.

**END OF SECTION 26 24 16**

# SECTION 26 27 26
# WIRING DEVICES

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Wall switches.
B Wall dimmers.
C Receptacles.
D Wall plates.

### 1.02 REFERENCE STANDARDS

A UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.
B UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.
C UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.
D UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.
E NFPA 70 - National Electrical Code; National Fire Protection Association, Including All Applicable Amendments and Supplements; 2020.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A Coordination:
1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B Sequencing:
1. Do not install wiring devices until final surface finishes and painting are complete.

### 1.04 SUBMITTALS

A Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
1. Wall Dimmers: Include derating information for ganged multiple devices.

B Certificates for Surge Protection Receptacles: Manufacturer's documentation of listing for compliance with UL 1449.
C Field Quality Control Test Reports.
D Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
E Operation and Maintenance Data:
1. Wall Dimmers: Include information on operation and setting of presets.
2. GFCI Receptacles: Include information on status indicators.

F Project Record Documents: Record actual installed locations of wiring devices.
G Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Screwdrivers for Tamper-Resistant Screws: Two for each type of screw.
2. Extra Keys for Locking Switches: Two of each type.
3. Extra Wall Plates: Two of each style, size, and finish.

### 1.05 QUALITY ASSURANCE

A Comply with requirements of NFPA 70.
B Maintain at the project site a copy of each referenced document that prescribes execution requirements.
C Products: Listed, classified, and labeled as suitable for the purpose intended.
D Product Listing Organization Qualifications: Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label Electrical and Mechanical Equipment.

**1.06 DELIVERY, STORAGE, AND PROTECTION**

A Store in a clean, dry space in original manufacturer's packaging until ready for installation.

**PART 2 PRODUCTS**

**2.01 WIRING DEVICE APPLICATIONS**

A Provide wiring devices suitable for intended use and with ratings adequate for load served.

B For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D Provide GFCI protection for receptacles installed within 6 feet of sinks.

E Provide GFCI protection for receptacles installed in kitchens.

F Provide GFCI protection for receptacles serving electric drinking fountains.

G Unless noted otherwise, do not use combination switch/receptacle devices.

**2.02 WIRING DEVICE FINISHES**

A Provide wiring device finishes as described below unless otherwise indicated.

B Wiring Devices, Unless Otherwise Indicated: Architect select color with stainless steel wall plate.

C Wiring Devices Installed in Finished Spaces: Architect select color with stainless steel wall plate.

D Wiring Devices Installed in Unfinished Spaces: Architect select color with galvanized steel wall plate.

**2.03 WALL SWITCHES**

A Manufacturers:

1. Hubbell Incorporated: www.hubbell.com/#sle.
2. Leviton Manufacturing Company, Inc.
3. Pass & Seymour, a brand of Legrand North America, Inc
4. Approved Equal.

B Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

C Standard Wall Switches: Industrial heavy duty grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, three way, or four way as indicated on the drawings.

**2.04 WALL DIMMERS**

A Manufacturers:

1. Leviton Manufacturing Company, Inc.
2. Lutron Electronics Company, Inc.
3. Pass & Seymour, a brand of Legrand North America, Inc
4. Or approved equal.

B Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

C Provide accessory wall switches to match dimmer appearance when installed adjacent to each other.

D Contractor shall ensure dimmer switch compatibility with luminaire controlled prior to ordering.

**2.05 RECEPTACLES**

A Manufacturers:

1. Hubbell Incorporated: www.hubbell.com/#sle.
2. Leviton Manufacturing Company, Inc.
3. Pass & Seymour, a brand of Legrand North America, Inc.
4. Approved equal.

5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

B Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498and where applicable FS W-C-596; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
2. NEMA configurations specified are according to NEMA WD 6.

C Convenience Receptacles:
1. Standard Convenience Receptacles: Industrial Heavy Duty Grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.

D GFCI Receptacles:
1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
   a. Provide test and reset buttons of same color as device.
2. Standard GFCI Receptacles: Extra Heavy Duty Grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
3. Weather Resistant GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

## 2.06 WALL PLATES

A Manufacturers:
1. Hubbell Incorporated.
2. Leviton Manufacturing Company, Inc.
3. Pass & Seymour, a brand of Legrand North America, Inc.
4. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

B Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Size: Semi-Jumbo; Midi Size.
3. Screws: Metal with slotted heads finished to match wall plate finish.

C Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

D Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.

E Weatherproof Covers for Wet and Damp Locations: Gasketed, thermoplastic, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed. Covers must be weatherproof while in use.

# PART 3 EXECUTION

## 3.01 EXAMINATION

A Verify that field measurements are as indicated.

B Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C Verify that wall openings are neatly cut and will be completely covered by wall plates.

D Verify that final surface finishes are complete, including painting.

E Verify that floor boxes are adjusted properly.

F Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

G Verify that conditions are satisfactory for installation prior to starting work.

## 3.02 PREPARATION

A Provide extension rings to bring outlet boxes flush with finished surface.

B Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

## 3.03 INSTALLATION

A Perform work in a neat and workmanlike manner.

B Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of wiring devices provided under this section.
1. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
2. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
3. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C Install wiring devices in accordance with manufacturer's instructions.

D Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I Install wiring devices plumb and level with mounting yoke held rigidly in place.

J Install wall switches with OFF position down.

K Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

L Do not share neutral conductor on branch circuits utilizing wall dimmers.

M Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

N Where receptacles are indicated to be mounted above counters they shall be mounted horizontally.

O Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings.

P Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

**3.04 FIELD QUALITY CONTROL**

A Inspect each wiring device for damage and defects.

B Operate each wall switch and wall dimmer with circuit energized to verify proper operation.

C Test each receptacle to verify operation and proper polarity.

D Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

E Correct wiring deficiencies and replace damaged or defective wiring devices.

**3.05 ADJUSTING**

A Adjust devices and wall plates to be flush and level.

B Adjust presets for wall dimmers according to manufacturer's instructions as directed by Architect.

**3.06 CLEANING**

A Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

**END OF SECTION 26 27 26**

# SECTION 26 28 13
# FUSES

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Fuses.

B Spare fuse cabinet.

### 1.02 REFERENCE STANDARDS

A NFPA 70 - National Electrical Code; National Fire Protection Association, Including All Applicable Amendments and Supplements; 2020.

B UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses; Current Edition, Including All Revisions.

C UL 248-8 - Low-Voltage Fuses - Part 8: Class J Fuses; Current Edition, Including All Revisions.

D UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses; Current Edition, Including All Revisions.

E UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

F UL 248-15 - Low-Voltage Fuses - Part 15: Class T Fuses; Current Edition, Including All Revisions.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A Coordination:

1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

### 1.04 SUBMITTALS

A Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

1. Spare Fuse Cabinet: Include dimensions.

B Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Extra Fuses: One set(s) of three for each type and size installed.
3. Fuse Pullers: One set(s) compatible with each type and size installed.
4. Spare Fuse Cabinet Keys: Two.

### 1.05 QUALITY ASSURANCE

A Comply with requirements of NFPA 70.

B Product Listing Organization Qualifications: Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label Electrical and Mechanical Equipment.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A Bussmann, a division of Eaton Corporation.

B Littelfuse, Inc.

C Mersen.

D Approved equal.

### 2.02 FUSES

A Provide products listed, classified, and labeled as suitable for the purpose intended.

B Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C Provide fuses of the same type, rating, and manufacturer within the same switch.

D Comply with UL 248-1.

E Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F Voltage Rating: Suitable for circuit voltage.

G Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

H Provide the following accessories where indicated or where required to complete installation:
1. Fuseholders: Compatible with indicated fuses.

**2.03 SPARE FUSE CABINET**

A Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.

B Cabinet shall be located in the main electrical room unless otherwise indicated by owner.

C Finish: Manufacturer's standard, factory applied grey finish unless otherwise indicated.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B Verify that mounting surfaces are ready to receive spare fuse cabinet.

C Verify that conditions are satisfactory for installation prior to starting work.

**3.02 INSTALLATION**

A Do not install fuses until circuits are ready to be energized.

B Install fuses with label oriented such that manufacturer, type, and size are easily read.

C Install spare fuse cabinet where indicated.

D Identify spare fuse cabinet in accordance with Section 26 05 53.

**END OF SECTION 26 28 13**

# SECTION 26 28 16.16
# ENCLOSED SWITCHES AND CIRCUIT BREAKERS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Enclosed safety switches.

B Enclosed circuit breakers.

### 1.02 REFERENCE STANDARDS

A UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

B NFPA 70 - National Electrical Code; National Fire Protection Association, Including All Applicable Amendments and Supplements; 2020.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A Coordination:

1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

### 1.04 SUBMITTALS

A Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

B Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include wiring diagrams showing all factory and field connections.
2. Contractor shall confirm that all lug sizes and quantities submitted are compatible with the conductors specified on the contract documents. Changes required to lug sizes and quantities due to lack of coordination between the contractor and the supplier are to be made at the contractor's expense.
3. It is the contractor's responsibility to ensure that the equipment submitted to comply with the requirements of this section are in compliance with the requirements and recommendations of the power system studies. Any changes recommended by the power system study shall be incorporated at no expense to the project.

C Field Quality Control Test Reports.

D Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

E Project Record Documents: Record actual locations of enclosed switches or circuit breakers.

F Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

### 1.05 QUALITY ASSURANCE

A Comply with requirements of NFPA 70.

B Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C Product Listing Organization Qualifications: Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label Electrical and Mechanical Equipment.

### 1.06 DELIVERY, STORAGE, AND HANDLING

A Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

**1.07 FIELD CONDITIONS**

A Maintain ambient temperature between 23 degrees F and 104 degrees F during and after installation of enclosed circuit breakers.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

A ABB/GE: www.geindustrial.com/#sle.

B Eaton Corporation.

C Schneider Electric; Square D Products.

D Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

**2.02 ENCLOSED SAFETY SWITCHES**

A Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B Provide products listed, classified, and labeled as suitable for the purpose intended.

C All switches shall be heavy duty type.

D Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet.
2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

E Horsepower Rating: Suitable for connected load.

F Voltage Rating: Suitable for circuit voltage.

G Auxilary Contacts: Suitable for 120v rated control circuit. Contractor is to provide auxilary contacts in any disconnecting means that is downstream from a frequency drive. aux contacts shall be mechanically tied to switching mechanisims and shall provide both a N.O. and N.C. contacts. verify with DIV 23 prior to ordering equipment.

H Short Circuit Current Rating:

1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
2. When a power system study is included in the contract, confirm the short circuit current rating of all devices with the results of the study prior to submitting for approval.

I Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

J Provide with switch blade contact position that is visible when the cover is open.

K Fuse Clips for Fusible Switches: As required to accept fuses indicated.

1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

L Conductor Terminations: Suitable for use with the conductors to be installed.

M Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

N Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

O Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: As indicated on the drawings.
2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

P Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

Q Heavy Duty Switches:

1. Comply with NEMA KS 1.
2. Conductor Terminations:
    a. Provide mechanical lugs for switch ratings less than 400 amperes.
    b. Provide compression lugs for switch ratings 400 amperes and above.
    c. Lug Material: Copper, suitable for terminating copper conductors only.
3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

**2.03 ENCLOSED CIRCUIT BREAKERS**

A Description: Units consisting of molded case circuit breakers individually mounted in enclosures.

B Provide products listed, classified, and labeled as suitable for the purpose intended.

C Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
1. Altitude: Less than 6,600 feet.
2. Ambient Temperature: Between 23 degrees F and 104 degrees F.

D Short Circuit Current Rating:
1. Provide enclosed circuit breakers with listed short circuit current rating not less than the available fault current at the installed location indicated on the drawings.

E Enclosed Circuit Breakers Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

F Auxilary Contacts: Suitable for 120v rated control circuit. Contractor is to provide auxilary contacts in any disconnecting means that is downstream from a frequency drive. aux contacts shall be mechanically tied to switching mechanisims and shall provide both a N.O. and N.C. contacts. verify with DIV 23 prior to ordering equipment.

G Conductor Terminations: Suitable for use with the conductors to be installed.

H Provide thermal magnetic circuit breakers for circuit breaker frame sizes less than 250 amperes.

I Provide electronic trip circuit breakers for circuit breaker frame sizes 250 amperes and above.

J Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

K Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.

L Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
1. Environment Type per NEMA 250: As indicated on the drawings.
2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
3. Provide surface-mounted enclosures unless otherwise indicated.

M Provide externally operable handle with means for locking in the OFF position.

N Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.

O Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

P MOLDED CASE CIRCUIT BREAKERS
1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:
    a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated.
    b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated. Series rating is not allowed.
3. Conductor Terminations:

a. Provide mechanical lugs for circuit breaker frame sizes less than 400 amperes.
b. Provide compression lugs for circuit breaker frame sizes 400 amperes and above.
c. Lug Material: Copper, suitable for terminating copper conductors only.

4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
   a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 100 amperes and larger.
5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
   a. Provide the following individually field-adjustable trip response settings:
      1) Long time pickup, adjustable by setting dial.
      2) Long time delay.
      3) Short time pickup and delay.
      4) Instantaneous pickup.
      5) Ground fault pickup and delay where ground fault protection is indicated.
6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A Verify that field measurements are as indicated.
B Verify that the ratings of the enclosed switches are consistent with the indicated requirements.
C Verify that mounting surfaces are ready to receive enclosed safety switches.
D Verify that conditions are satisfactory for installation prior to starting work.

### 3.02 INSTALLATION

A Install products in accordance with manufacturer's instructions.
B Install enclosed switches securely, in a neat and workmanlike manner.
C Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
D Provide required support and attachment in accordance with Section 26 05 29.
E Install enclosed switches and breakers plumb.
F Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.
G Provide grounding and bonding in accordance with Section 26 05 26.
H Provide fuses complying with Section 26 28 13 for fusible switches as indicated or as required by equipment manufacturer's recommendations.
I Set field-adjustable circuit breaker tripping function settings as directed.
J Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
K Identify enclosed switches and breakers in accordance with Section 26 05 53.

### 3.03 FIELD QUALITY CONTROL

A Perform inspections and tests listed in NETA ATS, Section 7.5.1.1 for breakers larger than 600A.
   1. Verify equipment nameplate is in accorance with contract documents.
   2. Inspect physical and mechanical condition.
   3. Inspect anchorage and anlignment.
   4. Verify unit is clean.
   5. Operate breaker to enusre smooth operation.
   6. Perform breaker adjustments in accorance with the power system study.
   7. Perform resistance measurements through bolted connectionswith a low-resistance ohmmeter.
   8. Perform insulation-resistance test for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed.
   9. Perform contact/pole resistance test.
   10. Determine long-time and short time pickup and delay settings by primary current injection.

11. Determine ground fault pickup and time delay by primary current injection.

B Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

**3.04 ADJUSTING**

A Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

**3.05 CLEANING**

A Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B Repair scratched or marred exterior surfaces to match original factory finish.

**END OF SECTION 26 28 16.16**

# SECTION 26 43 00
# SURGE PROTECTIVE DEVICES

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Surge protective devices for service entrance locations.

### 1.02 REFERENCE STANDARDS

A UL 1283 - Standard for Electromagnetic Interference Filters; Current Edition, Including All Revisions.

B UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

C NFPA 70 - National Electrical Code; National Fire Protection Association, Including All Applicable Amendments and Supplements; 2020.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to ordering equipment.

### 1.04 SUBMITTALS

A Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.

1. SPDs with EMI/RFI filter: Include noise attenuation performance.

B Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.

C Certificates: Manufacturer's documentation of listing for compliance with the following standards:

1. UL 1449.
2. UL 1283 (for Type 2 SPDs).

D Field Quality Control Test Reports.

E Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.

G Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

H Project Record Documents: Record actual connections and locations of surge protective devices.

### 1.05 QUALITY ASSURANCE

A Comply with requirements of NFPA 70.

B Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C Product Listing Organization Qualifications: Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label Electrical and Mechanical Equipment.

### 1.06 DELIVERY, STORAGE, AND PROTECTION

A Store in a clean, dry space in accordance with manufacturer's written instructions.

### 1.07 FIELD CONDITIONS

A Maintain field conditions within manufacturer's required service conditions during and after installation.

### 1.08 WARRANTY

A Manufacturer's Warranty: Provide minimum five year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.

B Exclude surge protective devices from any clause limiting warranty responsibility for acts of nature, including lightning, stated elsewhere.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A Field-installed, Externally Mounted Surge Protective Devices:

1. ABB/GE: www.geindustrial.com/#sle.
2. Current Technology; a brand of Thomas & Betts Power Solutions.
3. Schneider Electric; Square D Brand Surgelogic Products.
4. Liebert.
5. Approved equal.

B Source Limitations: Furnish surge protective devices produced by a single manufacturer and obtained from a single supplier.

**2.02 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS**

A Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.

B Unless otherwise indicated, provide field-installed, externally-mounted or factory-installed, internally-mouonted SPDs.

C List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.

D Protected Modes:

1. Wye Systems: L-N, L-G, N-G, L-L.

E UL 1449 Voltage Protection Ratings (VPRs):

1. 208Y/120V System Voltage: Not more than 700 V for L-N, L-G, and N-G modes and 1,000 V for L-L mode.

F UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.

G Enclosure Environment Type per NEMA 250: As indicated on the drawings.

H Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:

1. Provide surface-mounted SPD where mounted in non-public areas or adjacent to surface-mounted equipment.

**2.03 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS**

A Unless otherwise indicated, provide field-installed, externally mounted SPDs.

B Surge Current Rating:

1. Ampacity: 600 - 1000A 200 kA per mode 400 kA per phase.
2. Ampacity: 225 - 400A 150 kA per mode 300 kA per phase.
3. Ampacity: 125 - 225A 100 kA per mode 200 kA per phase.

C Opening of supplementary protective devices, internal or external, shall not be permissible during UL 1449 3rd Edition Nominal Discharge testing.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A Verify that field measurements are as indicated.

B Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.

C Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of drawings and manufacturer's instructions.

D Verify system grounding and bonding is in accordance with Section 26 05 26, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.

E Verify that conditions are satisfactory for installation prior to starting work.

**3.02 INSTALLATION**

A Perform work in a neat and workmanlike manner.

B Install products in accordance with manufacturer's instructions.

C Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D Unless indicated otherwise, connect service entrance surge protective device on load side of service disconnect main overcurrent device.

E Provide conductors with minimum ampacity not less than manufacturer's recommended minimum conductor size.

F Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.

G Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 26 05 26 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

H Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

**3.03 FIELD QUALITY CONTROL**

A Inspect and test in accordance with NETA ATS, except Section 4.

B Perform inspections and tests listed in NETA ATS Section 7.19.1.

C Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

**3.04 CLEANING**

A Repair scratched or marred exterior surfaces to match original factory finish.

**END OF SECTION 26 43 00**

# SECTION 26 51 00
# INTERIOR AND EXTERIOR LIGHTING

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Interior luminaires.
B Emergency lighting units.
C Exit signs.
D LED Drivers.
E Emergency power supply units.
F Lamps.
G Accessories.

### 1.02 REFERENCE STANDARDS

A IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2019.
B NFPA 70 - National Electrical Code; National Fire Protection Association, Including All Applicable Amendments and Supplements; 2020.
C NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
D UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
E UL 1598 - Luminaires; Current Edition, Including All Revisions.
F UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

### 1.03 ADMINISTRATIVE REQUIREMENTS

A Coordination:
1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

### 1.04 SUBMITTALS

A Shop Drawings:
1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
B Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
1. Drivers: Include wiring diagrams and list of compatible lamp configurations.
2. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.
C Certificates for Dimming Drivers: Manufacturer's documentation of compatibility with dimming controls to be installed.
D Field quality control reports.
E Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F Warranties.

G Operation and Maintenance Data: Instructions for each product including information on replacement parts.

H Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.
2. Extra Dri: Two percent of total quantity installed for each type, but not less than one of each type.

**1.05 QUALITY ASSURANCE**

A Comply with requirements of NFPA 70.

B Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C Product Listing Organization Qualifications: Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label Electrical and Mechanical Equipment.

**1.06 DELIVERY, STORAGE, AND PROTECTION**

A Receive, handle, and store products according to manufacturer's written instructions.

B Keep products in original manufacturer's packaging and protect from damage until ready for installation.

**1.07 FIELD CONDITIONS**

A Maintain field conditions within manufacturer's required service conditions during and after installation.

**PART 2 PRODUCTS**

**2.01 LUMINAIRE TYPES**

A Furnish products as indicated in luminaire schedule included on the drawings.

**2.02 LUMINAIRES**

A Provide products that comply with requirements of NFPA 70.

B Provide products that are listed and labeled as complying with UL 1598, where applicable.

C Provide products listed, classified, and labeled as suitable for the purpose intended.

D Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G Recessed Luminaires:

1. Ceiling Compatibility: Comply with NEMA LE 4.
2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
4. Luminaires Recessed in Fire Rated Ceiling: Provide fire rated tenting to match the fire resistant rating of the surrounding ceiling.

H LED Luminaires:

1. Components: UL 8750 recognized or listed as applicable.
2. Tested in accordance with IES LM-79 and IES LM-80.
3. Outdoor: Provide a minimum of 10 kV integral surge suppression.
4. Indoor: Provide a minimum of 2.5 kV integral surge suppression.

I Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

**2.03 EMERGENCY LIGHTING UNITS**

A Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C Battery:

1. Sealed maintenance-free nickel cadmium unless otherwise indicated on the lighting fixture schedule.
2. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation. All fixtures shall be equipped with self diagnostics in addition to the manual operation.

E Provide low-voltage disconnect to prevent battery damage from deep discharge.

F Accessories:

1. Provide compatible accessory mounting brackets where indicated or required to complete installation.
2. Provide compatible accessory wire guards where indicated.

**2.04 EXIT SIGNS**

A Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.

1. Number of Faces: Single- or double-face as indicated or as required for installed location.
2. Directional Arrows: As indicated or as required for installed location.

B Self-Powered Exit Signs:

1. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation. All fixtures shall be equipped with self diagnostics in addition to the manual operation.

C Accessories:

1. Provide compatible accessory wire guards where indicated.

**2.05 LED DRIVERS**

A Drivers - General Requirements:

1. Provide Drivers containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state Driver efficiency/efficacy standards.

B Dimmable LED Drivers:

1. Dimming Range: Continuous dimming from 100 percent to ten percent relative light output unless dimming capability to lower level is indicated in the fixture schedule, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed. Refer to drawings.
3. Square wave inverters shall not be used with LED emergency lighting. Sinusoidal wave inverters must be used.

**2.06 EMERGENCY POWER SUPPLY UNITS**

A Manufacturers:

1. Iota Engineering, LLC.
2. Emergilite
3. Dualite
4. Philips Emergency Lighting/Bodine.
5. Approved equal.
6. Manufacturer Limitations: Where possible, for each type of luminaire provide fluorescent emergency power supply units produced by a single manufacturer.

B Description: Self-contained emergency power supply units suitable for use with indicated luminaires, complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

C Compatibility:

1. Drivers: Compatible with electronic, standard magnetic, energy saving, and dimming AC ballasts, including those with end of lamp life shutdown circuits.

D Operation: Upon interruption of normal power source, solid-state control automatically switches connected lamp(s) to the emergency power supply for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

E Unit shall have a maximum of 5% total harmonic distortion with sine wave output. Square wave output is not acceptable.

F Battery: Sealed maintenance-free high-temperature nickel cadmium unless otherwise indicated. Normal expected life of 10 years.

G Diagnostics: Provide accessible and visible multi-chromatic combination test switch/indicator light to display charge, test, and diagnostic status and to manually activate emergency operation.

H Operating Temperature: From 32 degrees F to 122 degrees F unless otherwise indicated or required for the installed location.

**2.07 LAMPS**

A Lamps - General Requirements:

1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.
    a. Unless otherwise noted on the drawings color temperatures shall be as listed below. Notify engineer if there is an inconsistency in color temperatures listed in the fixture schedule prior to ordering.
        1) Interior Lighting: 4000 K
        2) Exterior Lighting: 4000 K

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A Verify that field measurements are as indicated.

B Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C Verify that suitable support frames are installed where required.

D Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E Verify that conditions are satisfactory for installation prior to starting work.

**3.02 PREPARATION**

A Provide extension rings to bring outlet boxes flush with finished surface.

B Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

**3.03 INSTALLATION**

A Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.

B All luminaire surge suppression shall be evaluated and tested in accordance with ANSI C62.41.2 standard.

C Install products in accordance with manufacturer's instructions.

D Provide required support and attachment in accordance with Section 26 05 29.

E Install luminaires securely, in a neat and workmanlike manner.

F Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

G Suspended Ceiling Mounted Luminaires:

1. Do not use ceiling tiles to bear weight of luminaires.
2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
4. Secure pendant-mounted luminaires to building structure.
5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gauge, connected from opposing corners of each recessed luminaire to building structure.

H Recessed Luminaires:

1. Install trims tight to mounting surface with no visible light leakage.
2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.

3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

I Suspended Luminaires:
1. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
2. Provide minimum of two supports for each luminaire, with no more than 4 feet between supports.
3. Install canopies tight to mounting surface.

J Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

K Install accessories furnished with each luminaire.

L Bond products and metal accessories to branch circuit equipment grounding conductor.

M Emergency Lighting Units:
1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
2. Install lock-on device on branch circuit breaker serving units, where served by a dedicated circuit.

N Exit Signs:
1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
2. Install lock-on device on branch circuit breaker serving units, where served by a dedicated circuit.

O Emergency Power Supply Units:
1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal ballast(s) in luminaire. Bypass local switches, contactors, or other lighting controls.
2. Install lock-on device on branch circuit breaker serving units.

P Identify luminaires connected to emergency power system in accordance with Section 26 05 53.

Q Install lamps in each luminaire.

R Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

## 3.04 WARRANTY

A Exit signs: Provide a minimum five year warranty. The battery shall have an additional 2 year pro rated warranty. Warranty period begins from the date of project acceptance.

B Emergency Luminaires: Provide a minimum of 5 year warranty for emergency luminaires. Batteries shall be warranted for 3 years with an additional 3 year pro-rated warranty. Warranty period begins from the date of project acceptance.

C Emergency Power supplies and inverters shall have a minimum of 10 year prorated warranty.

## 3.05 FIELD QUALITY CONTROL

A Inspect each product for damage and defects.

B Operate each luminaire after installation and connection to verify proper operation.

C Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply. Test shall be conducted for 90 minutes in accordance with NEC 700. Test shall be conducted a maximum of 10 days prior to final inspection and light level readings recorded at the beginning and end of the test shall be submitted to the engineer for review.

D Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

## 3.06 ADJUSTING

A Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

**3.07 CLEANING**

A Clean surfaces according to manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

**3.08 CLOSEOUT ACTIVITIES**

A Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

B After the designer final inspection prior to SCO final inspection and final acceptance replace all lamps that have failed and clean all lenses.

**3.09 PROTECTION**

A Protect installed luminaires from subsequent construction operations.

**END OF SECTION 26 51 00**

# SECTION 27 10 00
# STRUCTURED CABLING FOR VOICE AND DATA

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Communications system design requirements.
B Communications pathways.
C Copper cable and terminations.
D Fiber optic cable and interconnecting devices.
E Communications equipment room fittings.
F Communications outlets.
G Communications grounding and bonding.
H Communications identification.

### 1.02 RELATED REQUIREMENTS

A Section 07 84 00 - Firestopping.
B Section 26 05 26 - Grounding and Bonding for Electrical Systems.
C Section 26 05 33.13 - Conduit for Electrical Systems.
D Section 26 05 33.16 - Boxes and Cabinets.
E Section 26 05 53 - Identification for Electrical Systems: Identification products.
F Section 26 27 26 - Wiring Devices.

### 1.03 REFERENCE STANDARDS

A TIA-455-21 - FOTP-21 - Mating Durability of Fiber Optic Interconnecting Devices; 1988a (Reaffirmed 2012).
B TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2020.
C TIA-568.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards; 2018d, with Addenda (2020).
D TIA-568.3 - Optical Fiber Cabling and Components Standard; 2022e.
E TIA-569 - Telecommunications Pathways and Spaces; 2019e, with Addendum (2022).
F TIA-598 - Optical Fiber Cable Color Coding; 2014d, with Addendum (2018).
G TIA-606 - Administration Standard for Telecommunications Infrastructure; 2021d.
H TIA-607 - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2019d, with Addendum (2021).
I UL 444 - Communications Cables; Current Edition, Including All Revisions.
J UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.
K UL 1651 - Fiber Optic Cable; Current Edition, Including All Revisions.
L UL 1863 - Communications-Circuit Accessories; Current Edition, Including All Revisions.
M NFPA 70 - National Electrical Code; National Fire Protection Association, Including All Applicable Amendments and Supplements; 2020.

### 1.04 ADMINISTRATIVE REQUIREMENTS

A Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Communications Service Provider representative.
B Provide all labor, equipment, supplies, materials, and incidentals and all operations necessary for the "TURNKEY," fully operational, tested, and completed installation of a Complete Wiring Infrastructure to support owner supplied equipment for voice and data systems, in complete accordance with the Contract Documents.
C Coordination:
1. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.
2. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate with the Electrical Contractor for the Grounding of all cable trays and relay racks / cabinets. Provide telecommunications ground bars at each network closet as identified on plans.

4. The Structured Wiring Contractor shall coordinate with the electrical contractor such that if additional conduit sleeves are required for installation of the cabling infrastructure then the electrical contractor shall provide, install and seal as required.
5. Coordination of the Raceway installation and racks & equipment placement with the Owners IT Department and Electrical Contractor.
6. The Structured Wiring Contractor shall coordinate required wiring for Phone lines Circuits for the Fire Alarm System. He shall provide and install the voice lines from that vendor's outlet / panel to the Owners phone equipment. Terminate as indicated by owner's IT department.
7. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

D Arrange for Communications Service Provider to provide service.

**1.05 SUBMITTALS**

A Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

B Shop Drawings: Show compliance with requirements on isometric schematic diagram of network layout, showing cable routings, telecommunication closets, rack and enclosure layouts and locations, service entrance, and grounding, prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).

C Evidence of qualifications for installer.

D Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

E Test Plan: Complete and detailed plan, with list of test equipment, procedures for inspection and testing, and intended test date; submit at least 60 days prior to intended test date.

F Field Test Reports.

G Project Record Documents: Prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).

1. Record actual locations of outlet boxes and distribution frames.
2. Show as-installed color coding, pair assignment, polarization, and cross-connect layout.
3. Identify distribution frames and equipment rooms by room number on drawings.

H Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of project record documents.

**1.06 QUALITY ASSURANCE**

A Maintain at the project site a copy of each referenced document that prescribes execution requirements.

B Manufacturer Qualifications: At least 3 years experience manufacturing products of the type specified.

C Installer Qualifications: A company having at least 7 years experience in the installation and testing of the type of system specified, and:

1. Employing a BICSI Registered Communications Distribution Designer (RCDD).
2. Supervisors and installers factory certified by manufacturers of products to be installed.
3. Employing BICSI Registered Cabling Installation Technicians (RCIT) for supervision of all work.

D Products: Listed, classified, and labeled as suitable for the purpose intended.

E FCC Approval - The system shall be approved for direct interconnection to the telephone utility under Part 68 of FCC rules and regulations. Systems which are not FCC approved or utilized an intermediary device for connection, shall not be considered. Provide the FCC registration number of the system being proposed as a part of the submittal process.

F Product Listing Organization Qualifications: Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label Electrical and Mechanical Equipment.

**1.07 DELIVERY, STORAGE, AND HANDLING**

A Store products in manufacturer's unopened packaging until ready for installation.

B Keep stored products clean and dry.

**1.08 WARRANTY**

A Correct defective Work within a 1 year period after Date of Project Acceptance.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A Copper Cabling:
1. General Cable.
2. Panduit.
3. Commscope.
4. Superior Essex
5. Or approved Equal

B Fiber Cabling
1. General Cable.
2. Commscope.
3. Corning.
4. Or approved equal.

C Connectivity:
1. Panduit.
2. Commscope.
3. Leviton.
4. Hubbell.
5. Or approved equal.

D Wall Cabinets:
1. Middle Atlantic.
2. Hoffman.
3. Chatsworth.
4. Hubbell.

### 2.02 SYSTEM DESIGN

A As part of this Project the Structured Wiring Contractor shall provide and install ALL cabinets. relay racks /surge suppressor strips, horizontal /vertical wire management, Patch panels (Fiber / Copper) and Patch cords (Fiber / Copper), faceplates, connectors fiber/copper, SMB boxes for WAPS and Cameras, etc. for a fully complete infrastructure. Coordinate closely with the owners IT staff for placement of equipment in racks to accommodate owner provided network switches.

B Permits and Inspections: Obtain and pay for all permits and inspections required by all legal authorities and agencies having jurisdiction for the work. These permits or inspections shall be a part of the work of the Contractor performing the work.

C Provide a complete permanent system of cabling and pathways for voice and data communications, including cables, conduits and wireways, pull wires, support structures, enclosures and cabinets, and outlets.
1. Comply with TIA-568 (SET) (cabling) and TIA-569 (pathways) (commercial standards).
2. Comply with Communications Service Provider requirements.
3. Provide fixed cables and pathways that comply with NFPA 70 and TIA-607 and are UL listed or third party independent testing laboratory certified.
4. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F at relative humidity of 0 to 95 percent, noncondensing.
5. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.

D Existing Main Distribution Frame (MDF): Is located in the existing Building, refer to Plans.

E Intermediate Distribution Frames (IDF): Support structures for terminating horizontal cables that extend to telecommunications outlets.
1. Locate intermediate distribution frames as indicated on the drawings.

F Backbone Cabling: Cabling, pathways, and terminal hardware connecting intermediate distribution frames (IDF's) with main distribution frame (MDF), wired in star topology with main distribution frame at center hub of star.

G Cabling to Outlets: Specified horizontal cabling, wired in star topology to distribution frame located at center hub of star; also referred to as "links".

H Refer to Drawings for Data / Voice /TV / Access Point / Handset and I/P Camera locations.

**2.03 PATHWAYS**

A Conduit: As specified in Section 26 05 33.13; provide pull cords in all conduit.

B All telecommunications stub-ups and sleeves shall have insulated bushings to protect cabling. Bushings must be plenum rated.

**2.04 COPPER CABLE AND TERMINATIONS**

A Provide cables with lead content less than 300 parts per million.

B Copper Horizontal Cable: (Plenum Rated)

1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568.2 and listed and labeled as complying with UL 444.
2. Cable Type - Voice and Data: TIA-568.2 Category 6 UTP (unshielded twisted pair); 23 AWG.
3. Cable Capacity: 4-pair.
4. Cable Applications:
   a. Plenum Applications: Use listed NFPA 70 Type CMP plenum cable.
5. Cable Jacket Color -Data & Handsets Cable: Blue.
6. Cable Jacket Color - Voice Cable: White.
7. Cable Jacket Color - Camera: Green.
8. Cable Jacket Color - Wireless Access Points: Yellow

C Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool; use screw connections only where specifically indicated.

D Jacks and Connectors: Modular RJ-45, non-keyed, terminated with 110-style insulation displacement connectors (IDC); high impact thermoplastic housing; suitable for and complying with same standard as specified horizontal cable; UL 1863 listed.

1. Performance: 500 mating cycles.
2. Voice and Data Jacks: 8-position modular jack, color-coded for both T568A and T568B wiring configurations.

E Copper Patch Cords:

1. Description: Factory-fabricated 4-pair cable assemblies with 8-position modular connectors terminated at each end.
2. Patch Cords for Patch Panels:
   a. Quantity: 200, Length 3 ft.
   b. Quantity: 20, Length 6 ft.
   c. Quantity: 20, Length 3ft (Green for Camera's)
   d. Quantity: 20, Length 3ft (Yellow for Wireless Access Points)

**2.05 FIBER OPTIC CABLE AND INTERCONNECTING DEVICES**

A Provide cables with lead content less than 300 parts per million.

B Fiber Optic Backbone Cable: (Plenum Rated)

1. Description: Tight buffered, non-conductive fiber optic cable complying with TIA-568.3, TIA-598, ICEA S-83-596 and listed as complying with UL 444 and UL 1651.
2. Cable Type: Multimode, laser-optimized 50/125 um (OM3) complying with TIA-492AAAC.
3. Cable Capacity: 12 -fiber.
4. Cable Applications:
   a. Provide Fiber backbone cabling between the MDF and each IDF closet in a star topology.
   b. Plenum Applications: Use listed NFPA 70 Type OFNP plenum cable.
5. Cable Jacket Color:
   a. Laser-Optimized Multimode Fiber (OM3/OM4): Aqua.

C In field splicing of fiber optic cables shall not be permitted.

D Fiber Optic Interconnecting Devices:

1. Connector Type: SC.
2. Connector Performance: 500 mating cycles, when tested in accordance with TIA-455-21.
3. Connector tip material shall be ceramic;
4. Connectors shall accept a maximum fiber jacket diameter of 3.0 mm;

5. Connectors shall be spring loaded, bayonet style for a positive contact;
6. Connectors shall be keyed to prevent rotation after insertion;
7. Connectors shall utilize cured adhesive methods for assembly;
8. Maximum Attenuation/Insertion Loss: 0.3 dB.
9. All fibers shall be terminated.

**2.06 COMMUNICATIONS EQUIPMENT ROOM FITTINGS**

A Copper Cross-Connection Equipment:

1. Patch Panels for Copper Cabling: Sized to fit EIA/ECA-310 standard 19 inch wide equipment racks; 0.09 inch thick aluminum; cabling terminated on Type 110 insulation displacement connectors; printed circuit board interface.
   a. Jacks: Non-keyed RJ-45, suitable for and complying with same standard as cable to be terminated; maximum 48 ports per standard width panel.
   b. Capacity: Provide ports sufficient for cables to be terminated plus 25 percent spare.
   c. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606.
   d. Provide incoming cable strain relief and routing guides on back of panel.
   e. Provide cable management panels between each patch panel for twisted pair cable. Cable management panels shall be Panduit “WMP” series, or equal.

B Fiber Optic Cross-Connection Equipment:

1. Patch Panels for Fiber Optic Cabling: Sized to fit EIA/ECA-310 standard 19 inch wide equipment racks; 0.09 inch thick aluminum.
   a. Adapters: As specified above under FIBER OPTIC CABLE AND INTERCONNECTING DEVICES; maximum of 24 duplex adaptors per standard panel width.
   b. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606.
   c. Provide incoming cable strain relief and routing guides on back of panel.
   d. Provide rear cable management tray at least 8 inches deep with removable cover.
   e. Provide dust covers for unused adapters.

C Equipment Frames, Racks and Cabinets:

1. Component Racks: EIA/ECA-310 standard 19 inch wide.
2. Wall Mounted Cabinets: Front plexiglas door, louvered side panels, top and bottom cable access, and ground lug. Provide front and rear piano hinge to access front and back of rack. Rack shall be HUBBELL MCC48WMC19D or approved equal.
   a. Provide 1 cabinet in Room Number 608
3. Cabinets: Steel construction with corrosion resistant finish.

**2.07 COMMUNICATIONS OUTLETS**

A Outlet Boxes: Comply with Section 26 05 33.16.

1. Provide depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.
2. Provide and install (SMB) boxes at the ends of cameras and Wireless Access points. Patch Cable shall be connected to SMB and other end will plug into device (Camera or Wireless Access Point).

B Wall Plates:

1. Comply with system design standards and UL 514C.
2. Accepts modular jacks/inserts.
3. Capacity:
   a. Data or Combination Voice/Data Outlets: 6 individual ports.
4. Wall Plate Material/Finish - Flush-Mounted Outlets: Match wiring device and wall plate finish stainless with ID window to match devices specified in Section 26 27 26.
   a. Single gang, flush mountable.
   b. Shall accept data, telephone, fiber optic, MATV, video, audio and blank insert modules;
   c. Inserts shall snap in and out from the front of the Data Station Outlet;
   d. Face plates shall be supplied with pressure-sensitive icon labels;

e. At locations where Owner provided and installed VOIP wall phones are located the Structured Wiring Contractor shall coordinate with the owner for the compatible wall plate to support the owner provided VOIP phone.

5. Inserts (Insert colors shall match colors listed for cable type above. Coordinate final colors with owner)
   a. Provide Data Port inserts with the following features: RJ-45 type rated for Category 6;
      1) RJ-45 insert shall be configured to EIA-568 wiring standards;
      2) Attenuation through the RJ-45 port at 10/16 MHz shall be less than .015/.025 dB;
      3) Provide 110 style IDC terminations for all eight conductors of a UTP cable;
      4) Data port inserts shall be by Panduit, Commscope, Hubbell, or Leviton.
   b. Provide Telephone Inserts with the following featuresRJ-45 type rated for Category 6;
      1) RJ-45 insert shall be configured to USOC wiring standards;
      2) Provide 110 style IDC terminations for all six conductors of a UTP phone cable.
      3) Telephone inserts shall be by Panduit, Commscope, Hubbell, or Leviton
   c. Provide Fiber Optic Inserts with the following features:
      1) SC-SC type, feed-through connector;
      2) Connector type shall be multi-mode;
      3) Insert shall provide two SC connectors;
      4) Fiber Optic Inserts shall be by

**2.08 GROUNDING AND BONDING COMPONENTS**

A Comply with TIA-607.

B Comply with Section 26 05 26.

**2.09 IDENTIFICATION PRODUCTS**

A Comply with TIA-606.

**PART 3 EXECUTION**

**3.01 INSTALLATION - GENERAL**

A Comply with latest editions and addenda of TIA-568 (SET) (cabling), TIA-569 (pathways), TIA-607 (grounding and bonding), NECA/BICSI 568, NFPA 70, and SYSTEM DESIGN as specified in PART 2.

B Comply with Communication Service Provider requirements.

C Grounding and Bonding: Perform in accordance with TIA-607 and NFPA 70.

D Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

**3.02 PATHWAYS**

A The Wiring Contractor shall be responsible for reviewing and coordinating conduit installation for the Voice Data systems with the Division 26 Prime Contractor.

**3.03 INSTALLATION OF EQUIPMENT AND CABLING**

A Cabling:
   1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
   2. Do not over-cinch or crush cables.
   3. Do not exceed manufacturer's recommended cable pull tension.
   4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.
   5. Fiber cabling shall be routed using 1-1/4" minimum plenum rated innerduct supported with J-hooks at 36" on center.

B Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:
   1. At Distribution Frames: 36 inches.
   2. At Outlets - Copper: 24 inches.
   3. At Outlets - Optical Fiber: 24 inches.

C Copper Cabling:
   1. Category 6: Maintain cable geometry; do not untwist more than 1/2 inch from point of termination.
   2. For 4-pair cables in conduit, do not exceed 25 pounds pull tension.

3. Use T568B wiring configuration.

D Fiber Optic Cabling:
1. Prepare for pulling by cutting outer jacket for 10 inches from end, leaving strength members exposed. Twist strength members together and attach to pulling eye.
2. Support vertical cable at intervals as recommended by manufacturer.

E Wall-Mounted Enclosures:
1. Install to plywood backboards only, unless otherwise indicated.
2. Mount so height of topmost panel does not exceed 78 inches above floor.
3. Enclosures shall be grounded.
4. Coordinate placement of power outlets for electronics in enclosures prior to rough-in.

F Identification:
1. Use wire and cable markers to identify cables at each end.
2. Use manufacturer-furnished label inserts, identification labels, or engraved wallplate to identify each jack at communications outlets with unique identifier.
3. Use identification nameplate to identify cross-connection equipment, equipment racks, and cabinets.

## 3.04 FIELD QUALITY CONTROL

A Comply with inspection and testing requirements of specified installation standards.

B Visual Inspection:
1. Inspect cable jackets for certification markings.
2. Inspect cable terminations for color coded labels of proper type.
3. Inspect outlet plates and patch panels for complete labels.
4. Inspect patch cords for complete labels.

C Testing - Copper Cabling and Associated Equipment:
1. Test backbone cables for DC loop resistance, shorts, opens, intermittent faults, and polarity between connectors and between conductors and shield, if cable has overall shield.
2. Test operation of shorting bars in connection blocks.
3. Test each twisted pair cable segment (example: from the data station port through the patch bay and patch cable to the hub port connector). Publish a log of each test to verify that the cable segment passes the EIA/TIA-568 TEB-36 requirements for Category 6 compliance. Bind the test log in a booklet and turn the booklet over to the Owner. The test shall include:
   a. Connector/cable continuity - line mapping;
   b. Cable segment length;
   c. Dual near end cross talk (NEXT);
   d. Attenuation at 100 MHz;
   e. Attenuation per foot;
   f. Pass/fail results of each portion of the test above.

D Testing - Fiber Optic Cabling:
1. Backbone: Perform optical fiber end-to-end attenuation test using an optical time domain reflectometer (OTDR) and manufacturer's recommended test procedures; perform verification acceptance tests and factory reel tests.
2. Multimode Backbone: Perform tests in accordance with TIA-526-14.

E Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone.

**END OF SECTION 27 10 00**

**SECTION 27 51 13**
**INTERCOM SYS**

**PART 1 - GENERAL**

**1.01 INTERCOM EQUIPMENT.**

**1.02 INTERCOM CABLE.**

**1.03 ACCESSORIES.**

A RELATED SECTIONS
1. Section 26 05 33 - Raceway and Boxes for Electrical Systems
2. Section 26 05 26 - Grounding and Bonding for Electrical Systems

B **SCOPE: This system expansion will be part of a project Alternate to expand the existing Bogen Multicomm 2000 System to incorporate the renovated and new Gymnasium building. All raceway conduit and outlet boxes/speaker backboxes, handset outlets shall be part of the base bid. All of the wiring and connections associated with the Bogen Multicom will be part of the Alternate.**

C SUBMITTALS
1. Submit under provisions of Division 1.
2. Shop Drawings: Indicate cable routing and connections; equipment rack configuration; wiring diagrams.
3. Submit product data for each item of equipment and each cable type.
4. Submit manufacturer’s installation instructions.

D PROJECT RECORD DOCUMENTS
1. Submit record documents under provisions of Division 1.
2. Accurately record actual locations of devices and wiring.

E OPERATION AND MAINTENANCE DATA
1. Submit under provisions of Division 1.
2. Operation Data: Include instructions for routine operation of master and remote stations.
3. Maintenance Data: Include instructions for minor troubleshooting, preventive maintenance, and cleaning.

F QUALITY ASSURANCE
1. Supplier: Company by manufacturer and specializing in supplying products specified in this Section with minimum five years’ experience.
2. Installer: Company specializing in installing the products specified in this Section with minimum five years’ experience and must have office facility within 50 mile radius to project.
3. All items of equipment shall be designed by the manufacturer to function as a complete system and shall be accomplished by the manufacturer’s complete service notes and drawings detailing all interconnections.
4. The communication system supplied shall be listed by Underwriter’s Laboratories under UL Standard 1459. A copy of the UL listing card for the proposed system shall be included with the Contractor’s submittal.

G MAINTENANCE SERVICE
1. Furnish service and maintenance of intercom system for one year from Date of Substantial Completion.

**PART 2 - PRODUCTS**

**2.01 PRODUCTS**

A INTERCOM SYSTEM
1. Description: Voice communication between locations indicated on Drawings.

B MANUFACTURERS
1. Existing Paging System is a Bogen Multi-com 2000.

C INTERCOM UNITS (Bogen MCESS or equal)
1. Description: Surface wall mounted unit at height as shown on plans.
2. Nominal Size: 8.8° X 3.2” X 3.7°.
3. Construction: Tamper resistant.
4. Finish: Office White or Black.

5. Handset: Standard molded plastic telephone handset with 5 foot long permanently coiled cord.
6. Controls:
    a. Standard twelve button key pad.
    b. Audible signal for incoming call.
    c. Speaker disconnect by lifting handset.

D SPEAKER/BAFFLE/BACK BOX ASSEMBLY- Lowell P875X or equal
1. Classroom/hallway 1' X 2' loudspeaker unit Bogen CDS1x2U or equal.
2. Provide Bogen AT10A or equal at locations where volume control is indicated on plans.

E SPEAKER/HORN
1. 15 watt paging talk back speaker-horn (weatherproof) with adjustable tap transformer (25 volt). Bogen FMH-15T or equal

F WEATHERPROOF & VANDALPROOF BAFFEL
1. Square Lowell SQLK-6 baffle or equal for mounting speaker unit, LUH-15T or equal, baffle shall have concealed speaker mounting studs. Utilize in all.
2. Square recessed enclosure (Flush MTD.) - Lowell P875x-6.
3. Surface mounted enclosure - Lowell CB86-6 or equal.

G INTERCOM CABLING
1. Cable shielding and size shall be fully compatible with intercom system manufacturer’s recommendations. Classrooms West Penn fl 357 (plenum rated). Speaker only circuits West Penn #292 (plenum rated).

H PUNCH-DOWN BLOCKS
1. Provide 66-block and stand-off wall brackets mounted on 4’ x 4’ x 3/4” fire retardant plywood board, for all intercom terminations at head-end equipment.
2. Provide protectors on all intercom cabling. ITW LINX (ULTRALINX UP3P-39) or equal.
    a. Clamping Level 39 VDC solid state
    b. Reaction time of 1-5 nanoseconds
    c. 66-block mounting
    d. Warranty lifetime

I PROVIDE LIGHTNING/SURGE SUPPRESSION FOR INTERCOM SYSTEM.

**PART 3 - EXECUTION**

**3.01 EXECUTION**

A EXAMINATION
1. Verify that surfaces are ready to receive work.
2. Verify field measurements are as instructed by manufacturer.
3. Verify that required utilities are available, in proper location, and ready for use.
4. Beginning of installation means installer accepts conditions.

B INSTALLATION
1. Install in accordance with manufacturer’s instructions.
2. Intercom cabling shall be installed in conduit with bushings at both ends, from outlet box to above accessible ceiling. Cable above ceiling shall be neatly routed and properly supported.
3. Support all intercom cabling above ceiling with bridle rings spaced not more than 6 feet on centers.
4. Intercom cabling shield shall not be used as a conductor. Bond shield only at intercom cabinet.
5. Terminate cables on 66 blocks with surge protectors.
6. Provide additional expansion capacity and all components necessary, except handsets, for 10 additional stations.

C FIELD QUALITY CONTROL
1. Field testing will be performed under provisions of Division 1.
2. Perform operational test on completed installation to verify proper operation.
3. Replace equipment, components, and wiring to eliminate audible noise, clicks, pops, or hum when system is in standby or operation.
4. The Contractor shall provide all necessary transient protection on the AC power feed and on all station lines leaving or entering the building.

5. The Contractor shall note in his system drawings, the type and location of these protection devices as well as all wiring information.

D MANUFACTURER'S FIELD SERVICES

1. Prepare and start systems under provisions of Division 1.
2. Make final connections to units.
3. Perform field inspection and testing.
4. Demonstrate system operation.

E ADJUSTING

1. Adjust work under provisions of Division 1.
2. Adjust controls and configuration switches for operation as indicated.
3. Adjust wireless clock system, adding repeaters as needed for a fully operational system.

F DEMONSTRATION

1. Provide on-site systems demonstration and instructions under provisions of Division 1. Allow minimum of 16 hours.
2. Conduct walking tour of Project and briefly describe function, operation, and maintenance of each component.
3. Use submitted operation and maintenance manual as reference during demonstration and training.

**END OF SECTION 275113 27 51 13**

# SECTION 28 10 01
# ACCESS CONTROL

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Access control panel.
B Access control devices.
C Accessory devices.

### 1.02 RELATED SECTIONS

A Section 26 05 19 - Wires and Cables

### 1.03 REFERENCES

A NFPA 70 - National Electrical Code 2020.
B NFPA 72H - Guide for Test Procedures for Protective Signaling Systems.
C NFPA 730 - Guide for Premises Security

### 1.04 SYSTEM DESCRIPTION

A Access Control System: Expand the existing S2 Security Access Control System to new access controlled doors. Refer to plans for door locations. System includes: door controllers, power supplies ( by door hardware contractor), card readers, and all accessories and wiring required for a complete system. All access control components associated with door hardware shall be furnished and installed by the Access Control Contractor. Close coordination shall occur prior to any rough-in. A Pre-Installation Meeting shall occur prior to any work commencing.

### 1.05 SUBMITTALS

A Submit under provisions of Division 1.
B Shop Drawings: Indicate system wiring diagram showing each device and wiring connection required.
C Product Data: Provide electrical characteristics and connection requirements.
D Test Reports: Indicate satisfactory completion of required tests and inspections.
E Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.
F Protection Plan: Indicate doors with readers and device locations on floor plan for approval by Owner.

### 1.06 PROJECT RECORD DOCUMENTS

A Submit under provisions of Division 1.
B Record actual locations of all devices and path of wiring.

### 1.07 OPERATION AND MAINTENANCE DATA

A Submit under provisions of Division 1.
B Operation Data: Operating instructions.
C Maintenance Data: Maintenance and repair procedures.

### 1.08 QUALIFICATIONS

A Electrical Contractor shall employ an alarm system subcontractor that is licensed in the State of North Carolina and who specializes in installation of Products specified in this section with minimum five years' experience, and with service facilities within one hour of Project so as to provide prompt service.

### 1.09 REGULATORY REQUIREMENTS

A Conform to requirements of NFPA 70.
B Furnish Products listed and classified by UL or other third party testing agency recognized by The State of North Carolina as suitable for purpose specified and indicated.
C Architects Section 01 23 00, The preferred OCSS Access Control System is manufactured by S2 Netbox.

## PART 2 PRODUCTS

### 2.01 ACCESS CONTROL HARDWARE

A Provide S2 Security Netbox Access Control Solution with up to 32 doors of access control. Provide additional S2 Network Nodes where needed to accommodate additional access controlled doors.
B The S2 system shall be fully integrated and connected to the OCSS S2 Global ACS for centralized administration of card holder records.
C Provide power supplies to match all electric door hardware. See door hardware specifications.

D Provide HID Multiclass Mini-Mullion contactless card readers P/N #S2900PTNNEK0060-S2SEC or approved equal.

E All doors shall have:

1. REX Motion (Request to Exit Motion Sensor) Takex PU-PS520W or Honeywell CK-I5310WH.
2. Door Position Switch (internal mount) GE Magnetics Series 1078, 1" diameter or equal.

F Cards provided by OCSS.

G Wiring as required by manufacturer, shielded stranded, (plenum type).

H Wiring interconnection to network switch by Access Control contractor.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A A pre-installation meeting with Owner, Engineer and Contractors is required prior to installation of system.

B Install in accordance with manufacturer's instructions.

C Contractor to coordinate with OCSS and the OCSS S2 Global Contractor for proper programming of the S2 system and connection to the OCSS S2 Global system.

D Obtain account code and card start number from OCSS security shop prior to programming.

E Use plenum 4c#22-4 minimum size for data and signaling circuits.

F Use plenum 2c#18-2E to power motion detectors from power supplies.

G Access control panel shall be surface mounted 5' above finished floor.

H All conductors entering into control panel or component boxes shall be concealed in ¾" or 1" conduits. Conduits will be accessible to ceiling voids. All control panels shall have a minimum of two (2) conduits for cabling entering panel. No exposed conductors will be permitted at the panel or at any instrument box where field wiring, i.e. power supplies, transformers and other devices, terminate into an instrument box.

I Install all cables in permanent raceways within walls and inaccessible spaces. Support low voltage cables in accessible ceilings with J-Hooks. Cables shall be supported directly by the building structure. Bridle rings with saddles are also acceptable for cable supports attached to down rods or the ceiling cross beams. Do not use wire to support the J-Hooks or bridle rings. Route all low voltage cable in accordance with NEC. Use nylon bushings at ends of conduits.

J All 120V power supply wiring shall be in conduit. Coordinate locations with the electrical contractor.

K OCSS does not want door supplies above door locations. Therefore, locate at nearest Network closet. Coordinate locations with electrical contractor for 120V AC to power supply.

L No splices shall be permitted at any point in the system.

**3.02 SYSTEM TESTING AND CERTIFICATION**

A Upon completion of the Access Control and Video Intercom systems, OCSS Security and Contractors shall together test each and every initiating device for proper response and annunciation.

B After successful completion of inspections and tests, the warranty begins. In the event of malfunctions or excessive false alarms, the Contractor must take prompt corrective actions. The Owner may require a repeat of the Contractor's 100% system test or other inspections. Continued improper performance during the warranty period shall be cause to require the Contractor to remove the system.

**END OF SECTION 281301 28 10 01**

**SECTION 28 23 00.01**
**CCTV VIDEO MGMT**

## PART 1 GENERAL

### 1.01 GENERAL REQUIREMENTS

A The surveillance software shall be of manufacturer's official product line, designed for commercial and industrial use. OCSS Preferred Manufacturer is: Panasonic, See Architects Alternate Specification 012300.

B The CCTV surveillance system shall be IP cameras connected to POE switches via the local area network (LAN). Cameras shall be provided and installed by the CCTV Security Contracto. POE network switches and video server shall be owner provided and owner installed. Please note, Cat-6 Plenum rated Camera cabling for the cameras shall be provided, installed and tested per BICSI standards by the Division 27 Structured Wiring Contractor. Close coordination shall take place between the CCTV Security contractor and the Structured Wiring contractor for a complete and operational system.

### 1.02 QUALITY ASSURANCE

A The CCTV camera installation shall be performed by electronic technicians thoroughly trained by the manufacturer in the installation and service of the components.

B Electrical Contractor shall employ a subcontractor that is licensed in the State of North Carolina and who specializes in installation of products specified in this section with a minimum five years experience, and with service facilities within one hour of the project so as to provide prompt service.

### 1.03 REGULATORY REQUIREMENTS

A Conform to the requirements of 2020 NFPA 70.

B Furnish products listed and classified by UL or other third party testing agency recognized by the State of North Carolina as suitable for purpose specified and indicated.

### 1.04 RELATED SECTIONS

A 26 05 19 - Power Conductors and Cables

B 27 10 00 - Telephone/Data Systems

### 1.05 CERTIFICATIONS AND STANDARDS

A The surveillance at minimum shall comply with the following approvals:

1. Section 508 - Accessibility Act
2. FDCC - Federal Desktop Core Configuration
3. NFPA 70 - 2020 National Electric Code
4. NFPA 72H - Guide for Test Procedures for Protective Signalling Systems
5. NFPA 731 - Installation of Electronic Premises Security Systems
6. NFPA 730 - Guide for Premises Security

### 1.06 SUBMITTALS:

A Permits: The Contractor shall obtain all required permits and provide copies to the Owner/Architect/Engineer

B Product Literature: Complete manufacturer's product literature for all electronics, cable, cable supports, cable labels, outlet devices, and other products to be used in the installation. In addition, include instructions for storage, handling, protection, examination, preparation, and starting of product.whenever substitutions for recommended products are made, samples (when requested by the Owner/Architect/Engineer) and the manufacturer's supporting documentation demonstrating compatibility with other related products shall be included.

C A complete floor plan diagram indicating camera locations and model numbers shall be required as part of the submittal.

## PART 2 PRODUCTS

### 2.01 GENERAL (CAMERA SCHEDULE- REFER TO ELECTRICAL PLANS)

### 2.02 PROJECT RECORD DOCUMENTS

A Submit under provisions of Division 1.

B Record final as-built locations of all cameras.

### 2.03 OPERATION AND MAINTENANCE DATA

A Submit under provisions of Division 1.

B Operation Data: Operaing Instructions.

C Maintenance Data: Maintenance and repair procedures.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A The Contractor shall carefully follow instructions in documentation provided by the manufacturer to insure all steps have been taken to provide a reliable, easy-to-operate system.

B All software shall be tested and configured in accordance with instructions provided by the manufacturer prior to installation.

C All software products shall be the latest versions and most up-to-date builds provided by the manufacturer.

D All equipment requiring users to log on using a password shall be configured with user/site-specific password/passwords. No system/product default passwords shall be allowed.

E Exterior cameras: Provide an exterior 4x4 gang box for all exterior cameras. The exterior camera can be mounted on surface plate of the gang box. All connections will be made inside box. Provide plastic bushings or insulated throat connectors shall be used in all conduit terminations. Conduits are not required in ceilings for CCTV Systems. Provide plenum rated cables where required.

F Interior Cameras: Wire cameras to closest IDF room, coordinate installation with OCSS Security Shop maintenance technician.

**END OF DOCUMENT**

# SECTION 28 31 12
# INTRUSION DETECTION SYSTEM

## PART 1 GENERAL

### 1.01 SUMMARY

A The Intrusion Detection system specified herein shall be provided and installed by the contractor as part of the base. Bid. OCSS will not provide any equipment for this system.

B The electrical contractor shall provide all conduit, boxes and 120V AC wiring.

C The licensed low-voltage security contractor shall provide and install panel, key-pads, zone modules, low voltage wiring, devices and any accessory items including making final connections and testing for a complete system.

D The existing Napco Security System shall be expanded to the new/renovated areas.

### 1.02 RELATED SECTIONS

A Section 26 05 19 - Wires and Cables

### 1.03 REFERENCES

A NFPA 70 - National Electrical Code 2020.

B NFPA 72H - Guide for Test Procedures for Protective Signaling Systems.

C NFPA 730 -Guide for Premises Security.

D Architects Alternate Section 01 23 00. The OCSS preferred system is a GEMINI / NAPCO Integrated Control Communicator.

### 1.04 SYSTEM DESCRIPTION

A Intrusion Detection System: Protect building and selected areas from intrusion during secure hours.

B System shall be an integrated control/communicator for monitoring status of detection devices and communicating via dedicated telephone lines to multiple telephone numbers using two programmable reporting formats.

C The School shall be partitioned into separate protected areas as directed by OCSS Security.

D System capacity shall be such that every motion sensor is individually zoned and signal from fire alarm panel separately zoned.

E All equipment shall be provided by the Electrical and Security Contractors. No equipment will be provided by OCSS.

### 1.05 SUBMITTALS

A Submit under provisions of Division 1.

B Shop Drawings: Indicate system wiring diagram showing each device and wiring connection required.

C Product Data: Provide electrical characteristics and connection requirements.

D Test Reports: Indicate satisfactory completion of required tests and inspections.

E Manufacturers Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

F Protection Plan: Indicate building protection areas and device locations on floor plan for approval by Owner.

### 1.06 PROJECT RECORD DOCUMENTS

A Submit under provisions of Division 1.

B Record actual locations of initiating devices, signaling appliances, and end-of-line devices.

C The program and all zone information will be turned over to OCSS security department.

### 1.07 OPERATION AND MAINTENANCE DATA

A Submit under provisions of Division 1.

B Operation Data: Operating instructions.

C Maintenance Data: Maintenance and repair procedures.

### 1.08 QUALIFICATIONS

A Electrical Contractor shall employ an alarm system subcontractor that is licensed in the State of North Carolina and who specializes in installation of Products specified in this section with minimum five years experience, and with service facilities within 60 miles of Project site.

### 1.09 REGULATORY REQUIREMENTS

A Conform to requirements of NFPA 70.

B Furnish Products listed and classified by UL or other third party testing agency recognized by The State of North Carolina as suitable for purpose specified and indicated.

**PART 2 PRODUCTS**

**2.01 EXPANSION MODULE**

A 8 zone expander module with supervised zones and audible locator. NAPCO GEM-EZM8 or equal. Expansion module shall be by same manufacturer as the existing control panel.

**2.02 KEYPAD**

A Backlit 16 character LCD alphanumeric display keypad, with full sized touchtone keys that brighten when touched and built in four zone expansion module. NAPCO GEM-RPCAe2 or equal. Keypad shall be by same manufacturer as the existing control panel.

**2.03 POWER SUPPLY**

A Power supply: Adequate to serve control panel modules and remote detectors, minimum 5 amp-hour supervised power supply/charger. Include battery-operated emergency power supply with capacity for operating system in standby mode for 24 hours.

**2.04 INITIATING DEVICES**

A Passive Infrared Motion Detector:
1. Wide Angle - DSC-BRAVO 600 dual PIR
2. Long Range - Aritech AP-633/AP643 Passive Infrared Detector

**2.05 CONDUCTORS**

A Data / Signaling cable - 22 awg., 2 pair UTP, West Penn #25242 (plenum rated).
B Power cable -18 AWG 2 PR., stranded, West Penn #25225 (plenum rated).
C Network cable: Cat-6 (plenum rated).

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A Install and program in accordance with manufacturer's instructions.
B Use cables as described in B, 7 above, with bridle rings every 10" to properly cabling.
C Provide and install Cat-6 plenum cabling connection to owner's network. Coordinate closely with owner's Security and IT Departments.
D Prior to installation, final device locations and zoning shall be submitted and approved by Owner.
E All conductors shall be concealed in ¾" C to accessible ceiling void.
F Keypads shall be wall mounted 5' above finished floor. All circuiting routed from control panel and or instrument boxes shall be concealed in ¾"C or 1"C conduit. Conduit(s) shall be accessible to ceiling voids. No exposed conductors will be permitted at the panel or instrument boxes where field wiring" (i.e. power supplies, transformer, ezm's or any other devices terminate into an instrument box).
G Each device shall be individually zoned.
H No splices in conductors shall be permitted at any point in system.
I EZM modules shall not be mounted above ceiling. Mount EZM modules 5-0" off in a surface wall box (Mier Instruments or equal, 11" x 14" x 4") in mechanical/electrical rooms or Telco closets. Locate all EZM modules and power supplies on shop drawings for approval prior to installation.
J Support all cables above accessible ceilings with "J" hooks or saddled bridle rings fastened to structure. Cables shall not share J-hooks with other system cables.
K No exposed conductors permitted. Install nylon bushings in all conduits extended to ceiling void.
L Contractor is responsible for programming the system and testing functionality. (Contractor
M Provide lightning/surge suppressors for intrusion detection system.

**3.02 FIELD QUALITY CONTROL**

A Field inspection and testing will be performed under provisions of Division 1.
B Test in accordance with NFPA 72H.

**3.03 MANUFACTURERS FIELD SERVICES**

A Prepare and start systems under provisions of Division 1.
B Include services of technician to supervise installation, adjustments, final connections, system testing, and Owner training.

**3.04 SYSTEM TESTING AND CERTIFICATION**

A Upon completion of the installation of the intrusion detection system, authorized representatives shall together test each and every initiating device for proper response and annunciation. Each area shall be verified for proper office, classrooms, corridors, numbers/names and locations.

B After successful completion of inspections and test, the warranty period begins. In the event of malfunctions or excessive false alarms, the Contractor must take prompt corrective actions. The Owner may require a repeat of the Contractor's 100% system test or other inspections. Continued improper performance during the warranty period shall be cause to require the Contractor to remove the system.

**END OF SECTION 281601 28 31 12**

# SECTION 28 46 00
# FIRE DETECTION AND ALARM

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A An expansion of the existing Notifier 320 Fire alarm system. This includes the design and installation, including all components, wiring, and conduit for the renovated area. In addition this existing system shall be interconnected with the new voice evacuation system in the new Gymnasium building.

B Transmitters for communication with supervising station.

C Replacement and removal of existing fire alarm system components, wiring, and conduit indicated.

### 1.02 REFERENCE STANDARDS

A NFPA 70 - National Electrical Code; National Fire Protection Association, Including All Applicable Amendments and Supplements; 2020.

B NFPA 72 - National Fire Alarm and Signaling Code; 2013

C NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

### 1.03 SCOPE

A Expand the existing Notifier 320 Fire Alarm system to accommiodate the renovated area in the existing building. Contractor shall provide all parts and pieces required to achieve a fully functional system.

B If at any point the existing fire alarm system is inactive for any reason throughout the course of construction, the Contractor shall provide 24 hour fire watch. Coordinate exact fire watch requirements with the local fire marshal.

### 1.04 SUBMITTALS

A Proposal Documents: Submit the following with cost/time proposal:

1. NFPA 72 "Record of Completion", filled out to the extent known at the time.
2. Manufacturer's detailed data sheet for each control unit, initiating device, and notification appliance.
3. Certification by Contractor that the system design will comply with Contract Documents.

B Drawings must be prepared using the latest release of ACAD.

C Evidence of designer qualifications.

D Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:

1. NFPA 72 "Record of Completion", filled out to the extent known at the time.
2. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
3. System zone boundaries and interfaces to fire safety systems.
4. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
5. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
6. System response matrix.
7. System riser diagram
8. Battery calculations showing voltage drop after required standby time.
9. List of all devices on each signaling line circuit, with spare capacity indicated.
10. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
11. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
12. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
13. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
14. Certification by Contractor that the system design complies with Contract Documents.
15. Do not show existing components to be removed.

E Evidence of installer qualifications.

F Inspection and Test Reports:
1. Submit inspection and test plan prior to closeout demonstration.
2. Submit documentation of satisfactory inspections and tests.
3. Submit NFPA 72 "Inspection and Test Form," filled out.

G Operating and Maintenance Data: have one set available during closeout demonstration:
1. Original copy of NFPA 72 with portions that are not relevant to this project neatly crossed out by hand; label with project name and date.
2. Complete set of specified design documents, as approved by authority having jurisdiction.
3. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
4. List of recommended spare parts, tools, and instruments for testing.
5. Replacement parts list with current prices, and source of supply.
6. Detailed troubleshooting guide and large scale input/output matrix.
7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

H Project Record Documents: Have one set available during closeout demonstration:
1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
2. "As installed" wiring and schematic diagrams, with final terminal identifications.
3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.
4. Graphic Chart mounted behind plexiglass and secured to wall at FACP and remote annunciator(s). Graphic char shall indicate all fire alarm devices including the programmed addresses for each device. Frame shall not be removable with standard philips or flat head screw drivers.
5. A copy of the floor plans with device numbers shall be provided in the control panel. Provide a separate sheet for each floor scaled to be on 11 x17 sheets. All devices shall be clearly labeled and a legend provided on the drawings. Indicate locations of cabinets, modules, and end of line devices. Plans shall be bound and sheets laminated. Provide plan holder in panel or in locked box adjacent to panel keyed to match panel.
6. Provide CD copy of complete configuration data (site specific programming) for the system submitted to the engineer for distribution to the owner.
7. Contractor shall provide the following to the owner
   a. All software required, both for the installed fire alarm system and personal computer necessary to access the fire alarm system for trouble shooting, programming, modifications, monitoring, de-bugging, or similar functions.
   b. Complete documentation for all software for both the installed fire alarm system and for any interface PC software necessary for the functions described above.
   c. Interconnection cable where such is required to connect the fire alarm system to a PC.

I Closeout Documents:
1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
3. Certificate of Occupancy.
4. System Report: Provide Engineer two bound copies of the following for transfer to the owner.
   a. As-built wiring diagram showing all loop numbers and device addresses, plus terminal numbers and where they connect to control equipment.
   b. As-built wiring and conduit layout diagrams, including wire color code and/or label numbers, and showing interconnections in the system.

c. Electronic circuit diagrams of all control panels, modules, annunciators, communications panels, etc.
d. Manufacturer's detailed maintenance requirements.
e. Product data on all devices.
f. As-built calculation sheets showing system capacity and voltage drops.

J Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
1. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data.
2. In addition to the items in quantities indicated in PART 2, furnish the following:
a. All tools, software, and documentation necessary to modify the fire alarm system using Owner's personnel; minimum modification capability to include addition and deletion of devices, circuits, and zones, and changes to system description, operation, and evacuation and instructional messages.
b. One copy, on CD-ROM, of all software not resident in read-only-memory.
c. Extra Fuses: Two for each installed fuse; store inside applicable control cabinet.

**1.05 QUALITY ASSURANCE**

A Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer , with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.

B Installer Qualifications: Firm with minimum 5 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
4. Technician must be trained and individually certified by the manufacturer, for the Master Control Unit installed. Training must have occurred within the most recent 24 month. If NICET level III certification shall extend to 36 months.
5. Contract maintenance office located within 50 miles of project site.
6. Certified in the State in which the Project is located as fire alarm installer.
7. Only the installer may make programming changes and must be present at the 100% test, Designer's pre-final review and Owner's final inspection.

C Product Listing Organization Qualifications: Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label Electrical and Mechanical Equipment.

**1.06 WARRANTY**

A Provide the necessary expansion cards, etc. to the existing panel to accommodate the renovation. Provide a manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after Owner's acceptance.

B Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Owner's acceptance.

C Warranty shall cover all parts and labor required to correct any deficient parts.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

A Addressable analog fire alarm system:
1. Notifier. (Existing to be expanded)

**2.02 FIRE ALARM SYSTEM**

A Fire Alarm System: Expand the Existing Notifier 320 Addressable Fire Alarm system
1. Provide all components necessary, regardless of whether shown in Contract Documents or not.
2. Protected Premises: (Entire Building).
3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:

a. ADA Standards.
b. The requirements of the State Fire Marshal.
c. The requirements of the local authority having jurisdiction.
d. Applicable local codes.
e. Contract Documents (drawings and specifications).
f. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.

4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
5. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
6. Hearing Impaired Occupants: Provide visible notification devices in all public areas.

B Supervising Stations and Fire Department Connections: (Maintain the existing transmission method)
1. Public Fire Department Notification: By on-premises supervising station.
2. Remote Supervising Station: UL-listed central station under contract to facility.
3. Means of Transmission to Remote Supervising Station: Multi-technology digital alarm communicator trasnsmitter (DACT). DACT shall utilize one traditional phone line and be capable of IP phone and cellular communications to comply with the 2013 NFPA 72 requirements for multiple communication methods.
a. The following signals shall be reported as applicable
1) Fire Alarm
2) Fire Alarm System AC Power Trouble (loss of power for 1 hour or more).
b. Signal precedence to the supervising station shall be per NFPA 72 and as defined below.
1) Fire Alarm
2) Supervisory Signal
3) Trouble Signal
c. The DACT is existing and will remain it is compatible with the supervising station. Contractor shall verify proper signal receipt with supervising station and ensure compliance with NFPA 72.

C Circuits:
1. Initiating Device Circuits (IDC): Class A.
2. Signaling Line Circuits (SLC): Class A with no T taps.
3. Notification Appliance Circuits (NAC): Class B.

**2.03 EXISTING COMPONENTS**

A Existing Fire Alarm System: Remove existing components indicated and incorporate remaining components into new system, under warranty as if they were new; do not take existing portions of system out of service until new portions are fully operational, tested, and connected to existing system.
B Clearly label components that are "Not In Service."
C Remove unused existing components and materials from site and dispose of properly.

**2.04 FIRE SAFETY SYSTEMS INTERFACES**

A Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
1. Sprinkler water control valves.
2. Elevator shut-down control circuits.

B Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
1. Sprinkler water flow.
2. Kitchen hood suppression activation; also disconnect fuel source from cooking equipment.
3. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.
4. Duct smoke detectors.

C Elevators:
1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service.

2. Elevator Machine Room Heat Detector: Shut down elevator power prior to hoistway sprinkler activation.
3. Sprinkler pressure or waterflow: Shut down elevator power prior to hoistway sprinkler activation.

D HVAC:
1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

E Doors:
1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 08 71 00. Door hold open magnets may release 60 seconds after loss of 120V power.

F Kitchen exhaust hood extinguishing systems
1. Installation shall comply with the current accepted edition of NFPA 72 for the type of system installed.
2. System shall be interconnected with fire alarm system as a separate system address.

**2.05 COMPONENTS**

A General:
1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.
3. Consult with facility manager and local fire official prior to locating Master Control Unit, remote annunciator, or system printer.
4. System Capacity and General Operation: The system shall have the following capacities and general operation modes:
   a. The FACP shall provide, or be capable of expansion to 198 intelligent/addressable devices per Signaling Line Circuits (SLC) and 2000 annunciation points, minimum, per system. The number of SLCs provided shall be as indicated on the Drawings. Total points shall be as indicated on the drawings or otherwise specified.
   b. The FACP shall include a full featured operator interface control and annunciation panel that shall include a backlit, 80 minimum character liquid crystal display, individual, color coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.
   c. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel.

B Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.

C System Response Conditions.
1. Alarm Condition - When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:
   a. The system alarm LED shall flash.
   b. A local piezo-electric signal in the control panel shall sound.
   c. LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location.
   d. On systems equipped with a printer, printing and history storage shall log the information associated with each new fire alarm signal, along with the time and date of occurrence.
   e. All system outputs assigned via control-by-event equations to be activated by a particular point shall be executed.
   f. Activate all fire alarm Notification Appliances.
   g. Activate digital alarm communicator.
   h. Deactivate all door hold control relays.
   i. Activate control relays to initiate AHU shutdown.

j. In buildings with elevators, activate elevator recall sequence when elevator initiating device is activated.

2. Trouble or Supervisory Condition - When a trouble condition is detected the following stipulations apply:
   a. System AC power trouble shall not be sent unless maintained for 3 hours or more. Provide additional relays as required for this purpose.
   b. Provide adjustable time delay for all other trouble signals prior to transmission.
   c. Supervise all initiating, signaling, and notification circuits throughout the facility by way of monitor and control modules.
   d. Visually and audibly annunciate any trouble, supervisory condition on operator's terminals, panel display, and annunciators.

D Display: The system display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters. The display assembly shall contain, and display as required, custom alphanumeric labels for all intelligent detectors, addressable modules, and software zones.

1. The system display shall provide an 80 minimum-character back-lit alphanumeric Liquid Crystal Display (LCD).
2. The Display shall also provide four Light-Emitting-Diodes (LEDS), that will indicate the status of the following system parameters: AC POWER, SYSTEM ALARM, SYSTEM TROUBLE, and SIGNAL SILENCE.
3. The system display shall provide a touch key-pad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be accessible through the display interface assembly to prevent unauthorized system control or programming.

E Initiating Devices:

1. Addressable Systems:
   a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.
   b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.
2. Addressable Devices - General: All initiating devices shall be individually addressable. Addressable devices shall comply with the following requirements:
   a. All addressable spot type and duct smoke detectors shall be the analog type and the alarm system shall automatically compensate for detector sensitivity changes due to ambient conditions and dust build-up within detectors. This feature must be armed and sensitivities set prior to acceptance of the system.
   b. Address Setting: Addressable devices shall provide an address-setting means.
   c. Connections: Addressable devices shall be connected to a Signaling Line Circuit (SLC) with two (2) wires.
   d. Operational Indications: Addressable initiation devices shall provide dual alarm and power LEDs. Both LEDs shall flash under normal conditions, indicating that the device is operational and in regular communication with the control panel. Both LEDs shall be placed into steady illumination by the FACP to indicate that an alarm condition has been detected. The flashing mode operation of the detector LEDs shall be optional through the system field program. An output connection shall also be provided in the device base to connect an external remote alarm LED.
   e. Intelligent Initiation Devices: All smoke detectors shall be the “intelligent” in that smoke detector sensitivity shall be set through the FACP and shall be adjustable in the field through the field programming of the system. Sensitivity shall be capable of being automatically adjusted by the FACP on a time-of-day basis. Using software in the FACP, detectors shall be capable of automatically compensating for dust accumulation and other slow environmental changes that may affect performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.

f. Spot-type detectors must be the plug-in type, with a separate base (not a mounting ring), to facilitate their replacement and maintenance. The base shall have integral terminal strips for circuit connections, rather than wire pigtails. Each detector or detector base shall incorporate an LED to indicate alarm.

3. Smoke Detectors General Requirements:
   a. Spot-type detectors must be the plug-in type, with a separate base (not a mounting ring), to facilitate their replacement and maintenance. The base shall have integral terminal strips for circuit connections, rather than wire pigtails. Each detector or detector base shall incorporate an LED to indicate alarm.
   b. Device mounting Base: Unless otherwise specified all detectors shall be ceiling-mount and shall include a separate twist-lock base with locking tamper proof feature.
   c. Sounder Base: Where indicated on plans provide bases with a built-in (local) sounder rated at 85 dBA minimum, measured at 10 ft. Configure sounder bases such that sounders are activated under conditions as described in the Matrix.
   d. Test Means: The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel when in the “test” condition.
   e. Device Identification: Detectors shall store an internal identifying type code that the control panel shall use to identify the type of device. Device identifications shall be either ION, PHOTO, or THERMAL.
   f. Photoelectric Smoke Detectors: Photoelectric smoke detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.
   g. Ionization Smoke Detector: Ionization smoke detectors shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.
4. Thermal Detectors: Thermal Detectors shall be intelligent addressable devices rated at 135°F (58°C) and shall have a rate-of-rise element rated at 15° F. (9.4°C) per minute. It shall connect via two wires to the Fire Alarm Control Panel Signaling Line Circuit. Up to 99 intelligent heat detectors may connect to one SLC loop. Thermal detectors shall use an electronic sensor to measure thermal conditions caused by a fire and shall, on command from the control panel, send data to the panel representing the analog level of such thermal measurements.
5. Duct Smoke Detector: In-Duct Smoke Detector Housings shall accommodate a velocity rated photoelectric detector. The device, independent of the type used, shall provide continuous analog monitoring and alarm verification from the panel. When sufficient smoke is sensed, an alarm signal shall be initiated at the FACP. Proper installation and physical location of each duct detector and access door shall be coordinated between the electrical, the mechanical and the fire alarm sub-contractors and approved by the electrical and mechanical engineers prior to equipment installation.
   a. Each Duct detector shall have a hinged duct access panel, 12 x 12 inches minimum for sampling tube inspection and cleaning. Indicate airflow direction on the duct adjacent to detector using permanent decal.
   b. Duct detector sampling tubes shall extend the full width of the duct. Sampling tubes over 36 inches long must be provided with far end support for stability. Install sampling tube per manufacturer's instructions.
   c. All duct detectors shall be programmed for alarm.
6. Remote annunciator Indicator Lights (RAIL): RAILs shall be provided for initiating devices where indicated on the plans. RAILs shall be provided with a key type switch for testing of the annunciated device. All RAILs shall be 24 VDC.
7. Addressable Pull Stations - General: Addressable pull stations shall, on command from the Control Panel, send data to the panel representing the state of the manual switch. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored

to normal use except by the use of a key. All pull stations shall be dual-action, have a positive, visual indication of operation and utilize a key type reset. The Glass-break rods are not allowed.

F Notification Appliances:

1. Programmable Electronic Sounders (Horns): Sounders located outdoors or in damp or wet locations shall be listed for use in wet locations. Electric sounders shall operate with synchronized audible output and have the following specifications: .
   a. Voltage: Programmable electronic sounders shall operate on 24 VDC nominal.
   b. Programming: Electronic Sounders shall provide the ANSI 53.41 three-pulse temporal pattern audible evacuation signal, described in NFPA 72, with an output sound level of at least 90 dBA measured at 10 feet from the device. Output sound level shall be 120 dB maximum. Electronic Sounders shall be field programmable without the use of special tools.
2. Strobes: shall be located as shown on the Drawings and provided per the requirements of the NCSBC chapter #11 and ICC A117.1-2009. Strobe lights indicated for use exterior to the building shall be mounted at the indicated elevation and listed for use in wet locations. Strobe lights shall operate with synchronized flash output and have the following specifications:
   a. Voltage: Strobe lights shall operate on 24 VDC nominal.
   b. Maximum pulse duration: 2/10ths of one second.
   c. Strobe intensity and flash rate: Must meet minimum requirements of UL 1971. Provide strobe lights with minimum intensity Candela (Cd) rating of 15/75 Cd, or greater if shown otherwise on drawings.
3. Audible/Visual Combination Devices shall comply with all applicable requirements for both Programmable Electronic Sounders and Strobe Lights.

G Miscellaneous System Items

1. Addressable Dry Contact Monitor Module: Addressable Monitor Modules shall be provided to connect one supervised zone of non-addressable Alarm Initiating Devices (any Normally Open [N.O.] dry contact device) to one of the Fire Alarm Control Panel Signaling Line Circuit Loops. Monitor modules shall be installed as required by the system configuration. All required monitor modules may not be shown on the Drawings.
   a. Indication of Operation: An LED shall be provided that shall flash under normal conditions, indicating that the Monitor Module is operational and in regular communication with the control panel.
   b. Supervision: Unless specifically noted otherwise on the drawings provide one monitor module for each sprinkler switch.
2. Two Wire Detector Monitor Module: Addressable Monitor Modules shall be provided to connect one supervised IDC zone, Class A or alarm initiating devices (any N.O. dry contact device) to one of the Fire Alarm Control Panel Signaling Line Circuit Loops. Monitor modules shall be installed as required by the system configuration. All required monitor modules may not be shown on the Drawings. Indication of Operation: Unless otherwise indicated on the Drawings an LED shall be provided that shall flash under normal conditions, indicating that the Monitor Module is operational and in regular communication with the control panel.
3. Addressable Control Module: Addressable Control Modules shall be provided to supervise and control the operation of one conventional Notification Appliance Circuit (NAC) of compatible, 24 VDC powered, polarized Audio/Visual (A/V) Notification Appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contract relay. The control module shall provide address-setting means using DIP switches and shall also store an internal identifying code that the control panel shall use to identify the type of device. An LED shall be provided that shall flash under normal conditions, indicating that the control module is operational and is in regular communication with the control panel.
   a. Configuration: The control module NAC circuit may be wired for Class B with up to 1 Amp of inductive A/V signal, or 2 Amps of resistive A/V signal operation, or as a dry contact (Form C) relay. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC. The relay coil shall be magnetically latched to reduce wiring connection

requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.

b. Power Source: Audio/visual power shall be provided by a separate supervised power loop from the main fire alarm control panel or from a supervised, 3rd party listed remote power supply. AN power sources and connections are not shown on the Drawings

c. Test Switch: A magnetic test switch shall be provided to test the module without opening or shorting its NAC wiring.

4. Isolator Module: Isolator Modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop. The Isolator Module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC Loop. Modules must be readily accessible (not above ceiling) and clearly labeled.
   a. Operation: Isolator Modules shall operate such that if a wire-to-wire short occurs, the Isolator module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the Isolator Module shall automatically reconnect the isolated section. The Isolator Module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an Isolator Module after its normal operation.
   b. The Isolator Modules shall provide a single LED that shall flash to indicate that the Isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.
   c. Isolation modules must be provided in the following locations as a minimum.
      1) Immediately adjacent to the Main Fire Alarm Control Unit, at each end of the addressable loop. These two isolators must be within 15 feet of the Main Fire Alarm Control Unit.
      2) After each 20 initiating devices and control points on the addressable loop.
      3) For loops with 20 or less control points install isolation module in approximately the middle of the loop.
      4) Near the point where any addressable loop extends outside the building envelope.
      5) For loops covering more than one floor where addressable loop crosses between floors.
   d. Each isolation module must be clearly labeled, readily accessible for convenient inspection.
5. Water Flow Switch: Flow switches shall be integral, mechanical, non-coded, non-accumulative retard type. Flow switches shall have an alarm transmission delay time that is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds. Flow switches shall be located a minimum of one (1) foot from a fitting that changes the direction of the flow and a minimum of three (3) feet from a valve as required per NFPA 13. Installation: Water Flow Switches shall be connected by the Division 26 (Electrical) Contractor but furnished and installed by the Division 23 (Mechanical) Contractor.
6. Sprinkler and Standpipe Valve Supervisory Switch: Supervisory switch mechanisms shall be contained in a weatherproof housing that shall provide a 3/4 inch tapped conduit entrance and shall incorporate the necessary facilities for attachment to the valves. Switch housing shall be finished in red baked enamel. Mounting: Mount switch so as not to interfere with the normal operation of the valve and adjust to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.
7. Remote Annunciator Indicator Lights (RAIL): RAILs shall be provided with a key type switch for testing of the annunciated device. In addition, RAILs shall have the following features: Voltage: RAILs shall operate on 24 VDC nominal.
8. Door Hold-Open magnets:
   a. Door hold open magnets shall be suitable for mounting in a single gang electrical device box.
   b. Door hold open magnets shall be furnished with keepers, door chains, and other accessories as required to properly hold open doors as indicated on the Drawings.
   c. Wall mounted magnetic door holders and separate heavy duty closers shall be used instead of combination door control units.
   d. Holding force of the magnet shall be appropriate for the door to be held open. Door hold open magnets shall operate in a fail safe manner, i.e., the door shall release in event of a failure of voltage to the device.

e. Power Source: Door hold open magnets shall be configured to operate from a nominal 24 VDC system as supplied by the FACP or other power supply listed for the purpose.
f. All hold open magnet supply sources, whether a part of the FACP or whether derived from a separate power supply, shall be supervised.
g. Door hold open magnet circuits which use step-down transformers, 120 VAC, or local relays are not permitted.
h. Door shall close after 60 seconds of the power loss.

9. Battery Power Supply (BPS) &/or Supplementary Notification Appliance Circuit (SNAC): These types of panels shall be completely maintenance free, shall not require liquids, fluid level checks or refilling, and shall not be capable of producing spills and/or leaks. Batteries shall be sealed gel-cell type with expected life of 10 years. Battery voltage shall be as required by the FACP and related equipment. Battery shall have sufficient capacity to power the fire alarm system for not less than 60 hours plus 15 minutes of alarm upon a normal AC power failure. Battery cabinet shall be twice the size of the batteries it will contain. NAC circuits shall not exceed 75% of maximum current load allowed.
   a. The voltage drop at EOL must not exceed 14% of the expected battery voltage after the required standby and alarm times. Determine worst case voltage at far end of each NAC circuit. The results must not be than the minimum listed rating on the device.
   b. Where voltage drop or capacity limits are exceeded provide additional NAC panels as required for a fully functional system.
   c. All power supplies shall be capable of withstanding prolonged short circuits in the field wiring, either line-to-line or line-to-ground, without damage.
   d. All power supplies shall be equipped with battery charging using dual-rate charging techniques for fast battery recharge.
10. Enclosure: All equipment enclosures shall be third party listed suitable for surface or semi-flush mounting. Cabinet and front shall be corrosion resistant, given a rust-resistant prime coat, and manufacturer's standard finish. The door shall provide a key lock and a glass opening for viewing indicators. Door hinge shall be field selectable (left or right).

H Wiring

1. Addressable loop (signaling line) circuits shall be wired with type FPL/FPLR/FPLP fire alarm cable, AWG 18 minimum, low capacitance, twisted shielded copper pair. Cable shield drain wires are to be connected at each device on the loop to maintain continuity, taped to insulate from ground, and terminated at the FACP. Acceptable cables include Atlas 228-18-1-1STP, BSCC S1802s19 (same as EEC 7806LC), West Penn D975, D991 (AWG 16), D995 (AWG 14), or equal wire having capacitance of 30pf/ft. maximum between conductors. Belden 5320FJ acceptable if only FPL rating needed.
   a. Unshielded cable, otherwise equal to the above, is permitted to be used if the manufacturer’s installation manual requires, or states preference for, unshielded cable.
   b. In underground conduit, use Type TC or PLTC cable (PE insulated) to avoid problems from moisture.
   c. The following conductor color coding shall be maintained throughout the system:
      1) Initiating Circuits: Red (+)/White (-)
      2) Initiating Circuits, Smoke Only: Violet (+)/Grey (-)
      3) Signal Line Circuits: Red jacket with Red (+)/Black(-)
      4) Alarm Indicating Appliance Circuits: Blue (+)/Black(-)
      5) AHU Shutdown Circuits: Yellow (+)/Brown (-)
      6) Door Control Circuits: Orange
      7) Elevator Capture Circuits: Brown
2. Supervision must be provided between individual addressable modules and their associated contact type initiating devices.

I Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.

1. For each AC power circuit that interfaces with fire alarm equipment install an AC suppressor in a listed enclosure near the electrical panelboard, and trim excess lead lengths. Wind small coil in the branch

circuit conductor just downstream of the suppressor connection. Coil to be 5 to 10 turns, about 1" diameter, and securely tie-wrapped. This series impedance will improve the effectiveness of the suppressor in clipping fast rise time voltage transients.

2. Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350 V(ac), line-to-neutral, and 350 V(ac), line-to-line; do not use fuses.
3. Initiating Device Circuits, Notification Appliance Circuits, and Communications Circuits: Provide surge protection at each point where circuit exits or enters a building; rated to protect applicable equipment; for 24 V(dc) maximum dc clamping voltage of 36 V(dc), line-to-ground, and 72 V(dc), line-to-line.
4. On DC circuits extending outside the building: Provide surge protection at each point where circuit exits or enters a building, rated to protect applicable equipment.

J Locks and Keys: Deliver keys to Owner.

1. Provide the same standard lock and key for each key operated switch and lockable panel and cabinet; provide 5 keys of each type

K Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.

1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
2. Provide one for each control unit where operations are to be performed.
3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
4. Provide extra copy with operation and maintenance data submittal.

L SPARE PARTS:

1. The following spare parts shall be provided with the system. For multi-building projects, calculate quantities separately for each building that contains a dedicated fire alarm control panel. If FACP also serves auxiliary buildings (e.g., storage, boiler/chiller), calculate as if one building. Increase decimal quantities to the next higher whole number.
   a. • Fuses (If Used) 2 of each size in system
   b. Manual Fire Alarm Boxes 2% of installed quantity
   c. Addressable Control Relays 4% of installed quantity
   d. • Indoor Horns/Speakers with Strobes Lights 4% of installed quantity
   e. Indoor Strobe-only Notification Appliances 4% of installed quantity
   f. Monitor Modules (Addressable Interface) 4% of installed quantity
   g. Isolation Modules I Isolation Bases 4% of installed quantity
   h. Addressable, Electronic Heat Detectors 4% of installed quantity
   i. • Spot-Type Smoke Detectors I Sounder Bases 6% of installed quantity
   j. * No spares are required for projected beam, air sampling, or duct smoke detectors

## PART 3 EXECUTION

### 3.01 INSTALLATION

A Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.

B Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

C All equipment supplied must be specifically listed for its intended use and shall be installed in accordance with the manufactures recommendations. The contractor shall consult the manufacturer’s installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation. Contractor shall refer to the Riser/Connection diagram for all specific system installation/termination/wiring data.

D All system components shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load. Adhesives are not permitted to mount fire alarm system components to building surfaces or structure.

E The system shall be electrically supervised for open or ground fault conditions in SLC, alarm and control circuits. Removal of any detection device, alarm appliance, plug-in relay, system module, or standby battery connection shall also result in a trouble signal.

F When programming the system, activate the automatic drift compensation feature for all spot- type smoke detectors. Systems with alarm verification are not to have this feature activated without written direction from the owner's representative or the AHJ. Alarm verification must not be used with multi-sensor/multi-criteria detectors under any circumstances, as inadequate system response may result. Most applications of analog addressable smoke detectors do not require alarm verification to reduce nuisance alarms, as they are better able to discriminate between fire and common non-fire ambient events. A short operational test with normal occupancy can determine if transient ambient events are a problem

G Provide photoelectric smoke detector within 15 feet of every NAC Panel or other fire alarm control equipment. These detectors shall be provided weather shown on plans or not.

H Set spot-type smoke detector sensitivities to normal/medium, unless directed otherwise by the design engineer/owner's rep. High sensitivity may be appropriate in relatively benign, clean environments such as art museums and libraries, to improve system response time without causing nuisance alarms.

I Unless suitably protected against dust and other debris, spot type smoke detectors shall not be installed until final construction clean-up has been completed. In the even that detectors are damaged during construction due to failure to adequately protect devices, they shall be replaced by the contractor at no expense to the owner.

J Print a complete System Status and Programming Report after the above steps have been done. This must include the program settings for each alarm initiating device and the current sensitivity of each analog addressable smoke detector.

K Install instruction cards and labels.

L Provide engraved label at the Main Control Unit and secondary power supplies identifying the 120V power source including panelboard location, panelboard identifier, and branch circuit number.

M Identification of individual initiating devices is required. Assign each initiating device a unique number as follows, sequence starting from the FACP: (Addressable Loop # -- Device #). Show device numbers on as built plans and permanently mark each detector base so that it is readable on the floor below without having to remove detector. Labels must be typewritten with black lettering and clear background.

**3.02 CONDUIT AND WIRING**

A All fire alarm system wiring shall be in metal conduit, minimum 3/4", or surface metal raceway. All fire alarm system raceway, couplers, and connectors must meet performance and installation requirements as identified in other sections of this specification manual.

B Detection or alarm circuits must not be included in raceways containing AC power or AC control wiring. Within the Fire Alarm Control Panels, and 120V control wiring or other circuits must with an externally supplied voltage above 24 V must be properly separated from other circuits and have the appropriate warning label to alert service personnel to the potential hazard.

C There shall be no splices in the system other than at device terminal blocks, or on terminal blocks in cabinets.

D Permanent wire markers shall be used to identify all connections in the Main Fire Alarm Control Unit and other control equipment, at power supplies and terminal cabinets.

E In multistory buildings, all circuits leaving the riser on each floor shall feed through a labeled terminal block in a hinged enclosure accessible from the floor.

F All wiring terminal block screws shall have pressure wire connectors of the self-lifting or box lug type.

G All wiring shall be checked for grounds, opens, and shorts, prior to termination at panels and installation of detector heads. The minimum allowed resistance to ground between any two conductors shall be 10 megohms, as verified with an insulation resistance test. Provide Engineer with the results of these tests.

H The exterior of all junction boxes, including both sides of covers, containing fire alarm conductors shall be painted red. Box interior shall not be painted.

I Box covers shall be labeled to indicate the circuit(s) or function of the conductors contained within. Labels shall be neatly applied black lettering on clear background. Handwritten labels or embossed tape labels are not allowed.

J All conduits penetrating exterior walls must have internal sealing to prevent condensation from infiltrating humid air.

**3.03 INSPECTION AND TESTING FOR COMPLETION**

A Notify Owner 7 days prior to beginning completion inspections and tests.

B Notify State Construction Electrical Inspector at least 7 days in advance for observation by their personnel prior to final acceptance.

C Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

E Provide all tools, software, and supplies required to accomplish inspection and testing.

F Upon completion of the installation the Contractor and the Manufacturer's authorized installer together shall conduct a performance test of each and every alarm initiating device for proper response. The system shall operate for 48 hours prior to start of test. The Contractor shall be present for the full test.

G The A/E and owner must be given 7 days advance notice of the tests. All Audio Visual Device Testing shall be scheduled with the owner.

H 100% Test: The manufacturer or authorized distributor (by definition, "installer") must 100% test all site-specific software functions for the system and then provide a detailed report or check list showing the system's operational matrix. This documentation must be part of the "System Status and Programming Report".

1. Upon completion of the installation and its programming, the installer's technician shall test every alarm initiating device for proper response and indication, and all alarm notification appliances for effectiveness. Also, in coordination with the other building system contractors, all other system functions shall be verified, including (where applicable) elevator capture and the control of HVAC systems, door locks, pressurization fans, fire or smoke doors/dampers/shutters, etc. The engineer must be notified in advance of these 100% tests, to permit witnessing them if desired.
2. If AHU shutdown occurs for any alarm, then the matrix would indicate the specific control relay(s) for that function being commanded to operate for alarm from any initiating device. If a rolling steel fire door is to drop only upon waterflow alarm from its sprinkler zone, or upon any two spot smoke detectors in adjacent spaces being simultaneously in alarm, the matrix would show the door's control relay activating upon alarm from the applicable waterflow switch(es), or from any two smoke detectors in the selected spaces (AND gate).
3. The digital communicator shall be on-line and tested for proper communication to the receiving station.
4. All supervised circuits must also be tested to verify proper supervision. (Control circuits and remote annunciation lines are among those required to be supervised.)
5. All testing described above shall be repeated in the event that subsequent software or wiring modifications are determined necessary to meet the requirements of the contract documents. Such re-testing shall be included as part of the base bid and provided at no additional cost to the Owner.

I Test Documentation: The installer must fill out and submit the following documentation to the owner, through the engineer, prior to the AHJ's system acceptance inspection:

1. Written verification that this 100% system test was done with copy of print out generated during test.
2. The NFPA 72, "Record of Completion" Form. Use this form (no substitutes) to detail the system installation and also to certify that: (a.) It was done per Code, and (b.) The Code- required 100% test was performed. The fire alarm installer (manufacturer or authorized distributor's technician) must sign this form. If a representative of the AHJ, owner, or engineer witnesses the tests, in whole or in part, they must also sign the form to signify that fact only (annotating the form as needed to clarify their limited role).
3. For buildings with a smoke control or smoke purge system, an HVAC balance report, in the smoke control / smoke purge mode.
4. The System Status and Programming Report described in NFPA 72. This must be generated on the day of the system acceptance inspection and shall include the measured sensitivity of each smoke detector.
5. The purpose of doing Item above on the day of the inspection is to assure detector sensitivity has not been affected by construction dust. Prudent contractors will have taken measures to prevent detector contamination during construction, and will also have had the system do a detector sensitivity test and

printout prior to the day of the inspection, to make certain all devices are properly programmed and operating within their limits.

J After completion of the 100% system test and submission of documentation as described above the installer is to request the engineer to set up an inspection. The system must operate for at least two days prior to this inspection The responding Fire Department shall be notified of this, for pre-fire planning purposes. On local government projects, local fire authorities may also want to participate in system acceptance inspections. However, for State-owned property they have no inspection jurisdiction and, if present, are only to observe.

K PRE-FINAL INSPECTION: At the Owner's request and after passing the Designer's pre-final inspection, the Contractor and Manufacturer's authorized installer will conduct system test in the presence of the Owner and the Designer.

L FINAL INSPECTION: The fire alarm system will be inspected, with portions of it functionally tested. This will normally include the use of appropriate means to simulate smoke for testing detectors, as well as functionally testing the system interface with building controls, fire extinguishing systems and any off-premises supervising station. Operation of any smoke removal system will be checked as instructed by the AHJ. This statistical (sampling) inspection is intended to assure that the contractor has properly installed the system and performed the 100% operational test as required by NFPA 72. The electrical contractor shall provide two-way radios, ladders, and any other materials needed for testing the system, including a suitable smoke source.

1. Smoke control and smoke management systems are normally tested by measuring air flow rates and pressure differentials, plus observing any effect the system has on the operation of exit, elevator, and stairway doors. Testing with smoke "bombs" (smoke candles) is NOT appropriate because they produce cold chemical smoke that lacks buoyancy and, therefore, does not rise like the smoke from a fire.
2. The test will be conducted entirely by the Contractor. A copy of the final database software must be presented to the Owner before this test. The software shall be loaded from these disks into the system in the presence of the Owner. The review will then be conducted using this software. Any deficiencies shall be recorded and corrected. After the items have been corrected, the system shall be tested again.
    a. In the event of malfunctions or excessive nuisance alarms, the Contractor must take prompt corrective action. The Owner may require a repeat of the Contractor's 100% system test, or other inspections.
    b. Test Report: Upon successful completion of the Inspection and after the correction of all efficiencies, the manufacturer's authorized representative shall issue a test report to the Engineer and Owner, detailing and certifying the test.
    c. System Acceptance: After successful completion of the Final Inspection and recommendation of the Engineer and concurrance of the State Construction Office that all criteria for Final Acceptance have been achieved, the system will be accepted by the Owner. At this time the warranty period begins.

**3.04 OWNER PERSONNEL INSTRUCTION**

A Provide the following instruction to designated Owner personnel:
1. Hands-On Instruction: On-site, using operational system.
2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.

B Maintenance Technicians: Detailed training for electrical technicians, on programming, maintaining, repairing, and modifying; factory training:
1. Initial Training: Minimum of 8 hours of instruction, pre-closeout.
    a. Training shall cover at a minimum the following:
        1) Preventative maintenance service techniques and schedules, including historical data trending of alarm and trouble records.
        2) Overall system concepts, capabilities, and functions. Training shall be in depth, so that owner shall be able to take any device out of service and return any device to service without the need of manufacturer's approval or assistance.
        3) Explanation of all control functions, including training to program and operate the software.
        4) Methods and means of troubleshooting and replacement of all field wired devices.

5) Methods and procedures for trouble shooting the main fire alarm control panel, including field peripheral devices as to programming, bussing systems, internal panel and unit wiring, circuitry, and interconnections.
6) Manuals, drawings, and technical documentation. Actual system software used for training shall be provided in digital form and shall be left with the Owner at the completion of the training for the Owner's use in the future.

C Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

D Provide two copies of bound training summary to be referenced by owner's maintenance staff in the future.

**3.05 CLOSEOUT**

A Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
1. Be prepared to conduct any of the required tests.
2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
3. Have authorized technical representative of control unit manufacturer present during demonstration.
4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
5. Repeat demonstration until successful.

B Occupancy of the project will not occur prior to Project Acceptance.

C Project Acceptance of the project cannot be achieved until inspection and testing is successful and:
1. Approved operating and maintenance data has been delivered.
2. Spare parts, extra materials, and tools have been delivered.
3. All aspects of operation have been demonstrated to Owner.
4. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
5. Occupancy permit has been granted.
6. Specified pre-closeout instruction is complete.

**3.06 MAINTENANCE**

A Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
3. Record keeping required by NFPA 72 and authorities having jurisdiction.

B The manufacturer must maintain software version records on the system installed. The system software shall be upgraded free of charge if a new version is released during the warranty period.

C Provide trouble call-back service upon notification by Owner:
1. Provide on-site response within 2 hours of notification.
2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

D Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

E Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.

F Comply with Owner's requirements for access to facility and security.

**END OF SECTION 28 46 00**

**SECTION 28 46 01**
**FIRE DETECTION AND ALARM - VOICE EVACUATION**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A Fire alarm system design and installation, including all components, wiring, and conduit for the New Gymnasium building as indicated on plans..

B Transmitters for communication with supervising station.

### 1.02 REFERENCE STANDARDS

A NFPA 70 - National Electrical Code; National Fire Protection Association, Including All Applicable Amendments and Supplements; 2020.

B NFPA 72 - National Fire Alarm and Signaling Code; 2013

C NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

### 1.03 SCOPE

A A new complete and fully functional voice evacuation fire alarm and detection system. Contractor shall provide all parts and pieces required to achieve a fully functional system.

### 1.04 SUBMITTALS

A Proposal Documents: Submit the following with cost/time proposal:

1. NFPA 72 "Record of Completion", filled out to the extent known at the time.
2. Manufacturer's detailed data sheet for each control unit, initiating device, and notification appliance.
3. Certification by Contractor that the system design will comply with the contract documents.

B Drawings must be prepared using the latest release of ACAD.

C Evidence of designer qualifications.

D Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:

1. NFPA 72 "Record of Completion", filled out to the extent known at the time.
2. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
3. System zone boundaries and interfaces to fire safety systems.
4. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
5. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
6. System response matrix.
7. System riser diagram
8. Battery calculations showing voltage drop after required standby time.
9. List of all devices on each signaling line circuit, with spare capacity indicated.
10. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
11. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
12. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
13. Certification by the manufacturer of the control unit that the system design complies with the contract documents.
14. Certification by Contractor that the system design complies with the contract documents.

E Evidence of installer qualifications.

F Evidence of instructor qualifications; training lesson plan outline.

G Evidence of maintenance contractor qualifications, if different from installer.

H Inspection and Test Reports:

1. Submit inspection and test plan prior to closeout demonstration.
2. Submit documentation of satisfactory inspections and tests.

3. Submit NFPA 72 "Inspection and Test Form," filled out.

I Operating and Maintenance Data: have one set available during closeout demonstration:

1. Original copy of NFPA 72 with portions that are not relevant to this project neatly crossed out by hand; label with project name and date.
2. Complete set of specified design documents, as approved by authority having jurisdiction.
3. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
4. List of recommended spare parts, tools, and instruments for testing.
5. Replacement parts list with current prices, and source of supply.
6. Detailed troubleshooting guide and large scale input/output matrix.
7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

J Project Record Documents: Have one set available during closeout demonstration:

1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
2. "As installed" wiring and schematic diagrams, with final terminal identifications.
3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.
4. Graphic Chart mounted behind plexiglass and secured to wall at FACP and remote annunciator(s). Graphic char shall indicate all fire alarm devices including the programmed addresses for each device. Frame shall not be removable with standard philips or flat head screw drivers.
5. A copy of the floor plans with device numbers shall be provided in the control panel. Provide a separate sheet for each floor scaled to be on 11 x17 sheets. All devices shall be clearly labeled and a legend provided on the drawings. Indicate locations of cabinets, modules, and end of line devices. Plans shall be bound and sheets laminated. Provide plan holder in panel or in locked box adjacent to panel keyed to match panel.
6. Provide CD copy of complete configuration data (site specific programming) for the system submitted to the engineer for distribution to the owner.
7. Contractor shall provide the following to the owner
   a. All software required, both for the installed fire alarm system and personal computer necessary to access the fire alarm system for trouble shooting, programming, modifications, monitoring, de-bugging, or similar functions.
   b. Complete documentation for all software for both the installed fire alarm system and for any interface PC software necessary for the functions described above.
   c. Interconnection cable where such is required to connect the fire alarm system to a PC.

K Closeout Documents:

1. Certification by manufacturer that the system has been installed in compliance with his installation requirements, is complete, and is in satisfactory operating condition.
2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
3. Certificate of Occupancy.
4. System Report: Provide Engineer two bound copies of the following for transfer to the owner.
   a. As-built wiring diagram showing all loop numbers and device addresses, plus terminal numbers and where they connect to control equipment.
   b. As-built wiring and conduit layout diagrams, including wire color code and/or label numbers, and showing interconnections in the system.
   c. Electronic circuit diagrams of all control panels, modules, annunciators, communications panels, etc.
   d. Manufacturer's detailed maintenance requirements.
   e. Product data on all devices.

f. As-built calculation sheets showing system capacity and voltage drops.

L Maintenance Contract: The contractor shall submit a quote for a maintenance contract to provide all maintenance, test, and repair described in this specification and/or in accordance with NFPA 72. Include also a quote for unscheduled maintenance/repair, including hourly rates for technicians trained on this equipment, and response travel costs. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for a period of (5) years after expiration of the guaranty. Maintenance and testing shall be on a semiannual basis or as required whichever is most restrictive. A preventative maintenance schedule shall be provided by the Contractor that shall describe the protocol for preventative maintenance. The schedule shall include:

1. Semiannual systematic examination, adjustment and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays, water flow switches and all accessories of the fire alarm system.
2. Semiannual testing of each circuit in the fire alarm system.
3. Semi annual testing of each smoke detector in accordance with the requirements of NFPA 72.

M Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.

1. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data.
2. In addition to the items in quantities indicated in PART 2, furnish the following:
   a. All tools, software, and documentation necessary to modify the fire alarm system using Owner's personnel; minimum modification capability to include addition and deletion of devices, circuits, and zones, and changes to system description, operation, and evacuation and instructional messages.
   b. One copy, on CD-ROM, of all software not resident in read-only-memory.
   c. Extra Fuses: Two for each installed fuse; store inside applicable control cabinet.

## 1.05 QUALITY ASSURANCE

A Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.

B Installer Qualifications: Firm with minimum 5 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.

1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
4. Technician must be trained and individually certified by the manufacturer, for the Master Control Unit installed. Training must have occurred within the most recent 24 month. If NICET level III certification shall extend to 36 months.
5. Contract maintenance office located within 50 miles of project site.
6. Certified in the State in which the Project is located as fire alarm installer.
7. Only the installer may make programming changes and must be present at the 100% test, Designer's pre-final review and Owner's final inspection.

C Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

D Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

E Product Listing Organization Qualifications: Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label Electrical and Mechanical Equipment.

## 1.06 WARRANTY

A Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after Owner's acceptance.

B Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Owner's acceptance.

C Warranty shall cover all parts and labor required to correct any deficient parts.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A Addressable Voice analog fire alarm system: Refer to Architects Alternates for Preferred Owner Equipment. Owner's Preferred Fire Alarm System Manufacturer is Notifier.

1. Notifier: NFS2-640/DVC-EM
2. EST.
3. Simplex.
4. Or pre-approved equal.

### 2.02 FIRE ALARM SYSTEM

A Fire Alarm System: Provide a new automatic one-way voice evacuation fire detection and alarm system:

1. Provide all components necessary, regardless of whether shown in the contract documents or not.
2. Protected Premises: Entire building shown on drawings.
3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
   a. ADA Standards.
   b. The requirements of the State Fire Marshal.
   c. The requirements of the local authority having jurisdiction.
   d. Applicable local codes.
   e. The contract documents (drawings and specifications).
   f. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
5. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
6. Hearing Impaired Occupants: Provide visible notification devices in all public areas.

B Supervising Stations and Fire Department Connections:

1. Public Fire Department Notification: By on-premises supervising station.
2. On-Premises Supervising Station: Existing proprietary station operated by Owner, located at _____.
3. Remote Supervising Station: UL-listed central station under contract to facility.
4. Means of Transmission to On-Premises Supervising Station: Directly connected noncoded system.
5. Means of Transmission to Remote Supervising Station: Digital alarm communicator transmitter (DACT), 2 telephone lines. **This New FACP2 shall be interconnected with the existing Notifier NFS-320 FACP1 Panel. The DACT is existing at the FACP 1 Panel and will remain as the means of transmission.**
   a. The following signals shall be reported as applicable
      1) Fire Alarm
      2) Sprinkler Waterflow Alarm
      3) Carbon Monoxide Alarm
      4) Fire Pump Running Alarm
      5) Fire Pump Abnormal Status Supervisory Signal
      6) Sprinkler Valve Tamper Supervisory Signal
      7) Sprinkler Low Temperature / Air pressure supervisory signal
      8) Fire Alarm System AC Power Trouble (loss of power for 1 hour or more).
   b. Sprinkler and fire pump supervisory signals are permitted to be combined by the DACT for transmission. Coordinate with the fire marshal and the supervising station.
   c. Signal precedence to the supervising station shall be per NFPA 72 and as defined below.

1) Fire Alarm
2) Carbon Monoxide Alarm
3) Supervisory Signal
4) Trouble Signal
5) Security Alarm

d. The contractor must provide a DACT that is compatible with the supervising station. Coordinate with the supervising station prior to ordering and installing DACT. Contractor shall verify proper signal receipt with supervising station and ensure compliance with NFPA 72.

C Circuits:
1. Initiating Device Circuits (IDC): Class A.
2. Signaling Line Circuits (SLC): Class A with no T taps.
3. Notification Appliance Circuits (NAC): Class B.
4. Voice Signal Circuits: Class B

D Spare Capacity:
1. Initiating Device Circuits: Minimum 25 percent spare capacity.
2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
3. Speaker Amplifiers: Minimum 25 percent spare capacity.
4. Master Control Unit: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

E Power Sources:
1. Primary: Dedicated branch circuits of the facility power distribution system.
2. Secondary: Storage batteries.
3. Capacity: Sufficient to operate entire system for period 60 hours in standby with 15 minutes of full alarm at the end of the 60 hours..

**2.03 FIRE SAFETY SYSTEMS INTERFACES**

A Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
1. Sprinkler water control valves.
2. Fire pump(s).

B Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
1. Sprinkler water flow.
2. Kitchen hood suppression activation; also disconnect fuel source from cooking equipment.
3. Duct smoke detectors.

C HVAC:
1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

D Doors:
1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 08 71 00. Door hold open magnets may release 60 seconds after loss of 120V power.

E Sprinkler System Monitoring
1. The following sprinkler system alarm and supervisory functions shall be provided as part of the fire alarm system:
   a. Waterflow alarm, by sprinkler zone (not to exceed one floor).
   b. Supervision of each control valve.
   c. Supervision of air pressure, if used.
   d. Supervision of fire pump.
2. Sprinkler supervisory monitoring of flow switches, tamper switches, and similar functions shall be accomplished with a separate system address for each activity monitored.
3. Contractor shall be responsible for reviewing the fire protection drawings and providing the quantity of tamper switches, flow switches, air pressure sensors, monitor and relay modules as required by the fire protection system design.

**2.04 COMPONENTS**

A General:

1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.
3. Consult with facility manager and local fire official prior to locating Master Control Unit, remote annunciator, or system printer.
4. System Capacity and General Operation: The system shall have the following capacities and general operation modes:
    a. The FACP shall provide, or be capable of expansion to 198 intelligent/addressable devices per Signaling Line Circuits (SLC) and 2000 annunciation points, minimum, per system. The number of SLCs provided shall be as indicated on the Drawings. Total points shall be as indicated on the drawings or otherwise specified.
    b. The FACP shall include a full featured operator interface control and annunciation panel that shall include a backlit, 80 minimum character liquid crystal display, individual, color coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.
    c. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel.

B Fire Alarm Control Units, Initiating Devices, and Notification Appliances: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.

C Master Control Unit shall have the following features:

1. The system shall be addressable type, with 24vdc nominal operating voltage.
2. Upload/Download to PC Computer
3. Charger Rate Control
4. Drift Compensation
5. Automatic Day/Night Sensitivity Adjust
6. Device Blink Control
7. Pre-alarm Control Panel Indication
8. Trouble Reminder
9. NFPA 72 Smoke Detector Sensitivity Test
10. System Status Reports
11. Periodic Detector Test
12. Alarm Verification, by device, with tally
13. Non-Alarm Module Reporting
14. Block Acknowledge
15. Smoke Detector Maintenance Alert
16. Control-By-Time
17. The control panel shall be capable of printing historical data and device parameters and shall include all equipment necessary to produce printouts, including an external printer and shall be U.L. listed as meeting the NFPA 72 sensitivity testing and maintenance requirements without the need for manually removing and testing each smoke detector. The control panel shall provide a display and a printed list of these sensitivity measurements as a permanent record of the required sensitivity testing. The system shall also annunciate a trouble condition when any smoke detector approaches 80% of its alarm threshold due to gradual contamination, with an annunciation of the location of the smoke detector requiring service. If any specialized equipment must be used to program any function of the smoke detector devices, then one must be furnished as part of the system.
18. The system shall perform time based control functions including automatic changes of specified smoke detector sensitivity settings.

19. System shall provide as a feature an alternate signal processing algorithm to verify the presence of smoke. The algorithm shall be selectable during system programming. The total effective delay created by the verification algorithm shall not exceed 60 second.
20. Audible evacuation signals
    a. Speakers shall be capable of generating a temporal three alarm as well as voice messages as required.
    b. Panel shall operate in one of the three evacuation signal modes identified below:
        1) Automatic: System operates in its pre-programmed mode with temporal three alarm and pre-recorded message.
        2) Manual: System activates temporal three alarm and pre-recorded message based on manual activation at the main panel.
        3) Paging: The temporal three alarm will sound continuously until the microphone button at the main panel or remote annunciator is pressed for a live voice message. Once button is released the temporal 3 alarm will resume.
    c. Provide zone selector switches so that any or all voice evacuation zones may be manually paged at a time.
    d. At a minimum the voice alarm zone shall be as described below. Coordinate with local fire marshal for additional zone requirements.
        1) Each Individual Floor
        2) Each Stairwell
        3) Elevator Lobbies/Area of Rescue Assistance
        4) Elevator Cabs
21. A hand-held push to talk microphone with minimum of 5 foot coiled extension cable. Microphone shall be recessed in the main fire alarm panel enclosure.

D Central Processing Unit: The Central Processing Unit (CPU) shall communicate with, monitor, and control all other modules within the control panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the system display by the CPU.

1. The CPU shall contain and execute all control-by-event (including ANDing, ORing, NOTing, CROSSZONEing) programs for specific action to be taken if an alarm condition is detected by the system. Such control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost with system primary and secondary power failure. The CPU shall also provide a real-time clock for time annotation of all system displays. The Time-of-Day and date shall not be lost if system primary and secondary power supplies fail.
2. Digitized electronic signals shall employ check digits or multiple polling. In general a single ground or open on any system signaling line circuit or initiating device circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
3. The CPU shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems that require the use of external programmers or change of EPROMs are not acceptable.
4. Loss of power: Alarm signals arriving at the main FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.
5. The system shall have multiple access levels so owner's authorized personnel can disable individual alarm inputs or normal system responses (outputs) for alarms, without changing the system's executive programming or affecting operation of the rest of the system. The process on how to do this must be included in the training required to be given to the owner's designated personnel, and must also be part of the written documentation provided by the fire alarm equipment supplier.

E System Response Conditions.

1. Alarm Condition - When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:
    a. The system alarm LED shall flash.
    b. A local piezo-electric signal in the control panel shall sound.

c. LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location.
d. On systems equipped with a printer, printing and history storage shall log the information associated with each new fire alarm signal, along with the time and date of occurrence.
e. All system outputs assigned via control-by-event equations to be activated by a particular point shall be executed.
f. Activate all fire alarm Notification Appliances.
g. Activate IP digital alarm communicator.
h. Deactivate all door hold control relays.
i. Activate control relays to initiate AHU shutdown.
j. In buildings with elevators, activate elevator recall sequence when elevator initiating device is activated.

2. Trouble or Supervisory Condition - When a trouble condition is detected the following stipulations apply:
a. System AC power trouble shall not be sent unless maintained for 3 hours or more. Provide additional relays as required for this purpose.
b. Provide adjustable time delay for all other trouble signals prior to transmission.
c. Supervise all initiating, signaling, and notification circuits throughout the facility by way of monitor and control modules.
d. Visually and audibly annunciate any trouble, supervisory condition on operator's terminals, panel display, and annunciators.

F Operators Control: Provide an operators interface which allows the following minimum functions. In addition, the operators interface shall support any other functions required for system control and/or operation:
1. Acknowledge (ACK/STEP) Switch
2. Signal Silence Switch
3. Alarm Silence Switch
4. System Reset Switch
5. System Test Switch
6. Lamp Test Switch
7. Elevator Recall Override Switch.
8. AHU Shutdown Override Switch.

G Display: The system display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters. The display assembly shall contain, and display as required, custom alphanumeric labels for all intelligent detectors, addressable modules, and software zones.
1. The system display shall provide an 80 minimum-character back-lit alphanumeric Liquid Crystal Display (LCD).
2. The Display shall also provide four Light-Emitting-Diodes (LEDS), that will indicate the status of the following system parameters: AC POWER, SYSTEM ALARM, SYSTEM TROUBLE, and SIGNAL SILENCE.
3. The system display shall provide a touch key-pad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be accessible through the display interface assembly to prevent unauthorized system control or programming.

H Printer: For systems exceeding 100 addressable points, 3 occupied floors in height, or 60,000 square feet, Provide a printer to provide hard-copy printout of all changes in status of the system. The printers shall time stamp such printouts with the current time-of-day and date. The printer shall be standard carriage with 80 characters per line and shall use standard pin-feed paper. Thermal printers are not acceptable. The printer shall operate from a 120V, 60 Hz power source. Provide a table and stand for printer in main data room.

I Remote Annunciators: Annunciator shall communicate with the fire alarm control panel via an EIA-485 communications loop (four-wire) and shall individually annunciate all zones in the system. System zones

shall be as indicated on the Drawings. Up to 10 annunciators may be co.

1. Annunciator shall be capable of initiating manual paging to override the pre-recorded message. Provide individual speaker zone selector switches so that the first responder may select some or all of the zones to manually page at a time.
2. Annunciator Indicators: The annunciator shall provide a red Alarm LED per zone, and a yellow Trouble LED per zone. The annunciator shall also have an "ON-LINE" LED, local piezo sounder, local acknowledge/lamp test switch, and custom zone/function identification labels. Annunciator switches may be used for System control such as, Global Acknowledge, Global Signal Silence, Alarm Resound, and Global System Reset. All annunciator switches and indicators shall be software programmable.
3. LCD Alphanumeric Display Annunciator: The Alphanumeric Display Annunciator shall be a supervised, remotely located back-lit LCD display containing a minimum of eighty (80) characters for alarm annunciation in clear English text. The LCD Annunciator shall display all alarms and trouble conditions in the system.
4. System Capacity: The system shall allow a minimum of four LCD annunciators. In addition to annunciation functions, each LCD annunciator shall be capable of the following software programmed system functions: Acknowledge, Signal Silence, Alarm Resound, and Reset.
5. Connections: The annunciator shall connect to a two-wire EIA-485 interface. The two- wire connection shall be capable operation at distances of 6,000 feet. Provide interface to fiber optic cable systems and/or repeater units where such are indicated on the Drawings.
6. Annunciator shall be equipped with a hand-held push to talk microphone with minimum of 5 foot coiled extension cable. Microphone shall be recessed in the main fire alarm panel enclosure.

J Initiating Devices:

1. Addressable Devices - General: All initiating devices shall be individually addressable. Addressable devices shall comply with the following requirements:
   a. All addressable spot type and duct smoke detectors shall be the analog type and the alarm system shall automatically compensate for detector sensitivity changes due to ambient conditions and dust build-up within detectors. This feature must be armed and sensitivities set prior to acceptance of the system.
   b. Address Setting: Addressable devices shall provide an address-setting means.
   c. Connections: Addressable devices shall be connected to a Signaling Line Circuit (SLC) with two (2) wires.
   d. Operational Indications: Addressable initiation devices shall provide dual alarm and power LEDs. Both LEDs shall flash under normal conditions, indicating that the device is operational and in regular communication with the control panel. Both LEDs shall be placed into steady illumination by the FACP to indicate that an alarm condition has been detected. The flashing mode operation of the detector LEDs shall be optional through the system field program. An output connection shall also be provided in the device base to connect an external remote alarm LED.
   e. Intelligent Initiation Devices: All smoke detectors shall be the "intelligent" in that smoke detector sensitivity shall be set through the FACP and shall be adjustable in the field through the field programming of the system. Sensitivity shall be capable of being automatically adjusted by the FACP on a time-of-day basis. Using software in the FACP, detectors shall be capable of automatically compensating for dust accumulation and other slow environmental changes that may affect performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.
   f. Spot-type detectors must be the plug-in type, with a separate base (not a mounting ring), to facilitate their replacement and maintenance. The base shall have integral terminal strips for circuit connections, rather than wire pigtails. Each detector or detector base shall incorporate an LED to indicate alarm.
2. Smoke Detectors General Requirements:
   a. Spot-type detectors must be the plug-in type, with a separate base (not a mounting ring), to facilitate their replacement and maintenance. The base shall have integral terminal strips for

circuit connections, rather than wire pigtails. Each detector or detector base shall incorporate an LED to indicate alarm.

b. Device mounting Base: Unless otherwise specified all detectors shall be ceiling-mount and shall include a separate twist-lock base with locking tamper proof feature.

c. Sounder Base: Where indicated on plans provide bases with a built-in (local) sounder rated at 85 dBA minimum, measured at 10 ft. Configure sounder bases such that sounders are activated under conditions as described in the Matrix.

d. Test Means: The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel when in the “test” condition.

e. Device Identification: Detectors shall store an internal identifying type code that the control panel shall use to identify the type of device. Device identifications shall be either ION, PHOTO, or THERMAL.

f. Photoelectric Smoke Detectors: Photoelectric smoke detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

g. Ionization Smoke Detector: Ionization smoke detectors shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.

3. Thermal Detectors: Thermal Detectors shall be intelligent addressable devices rated at 135°F (58°C) and shall have a rate-of-rise element rated at 15° F. (9.4°C) per minute. It shall connect via two wires to the Fire Alarm Control Panel Signaling Line Circuit. Up to 99 intelligent heat detectors may connect to one SLC loop. Thermal detectors shall use an electronic sensor to measure thermal conditions caused by a fire and shall, on command from the control panel, send data to the panel representing the analog level of such thermal measurements.

4. Duct Smoke Detector: In-Duct Smoke Detector Housings shall accommodate a velocity rated photoelectric detector. The device, independent of the type used, shall provide continuous analog monitoring and alarm verification from the panel. When sufficient smoke is sensed, an alarm signal shall be initiated at the FACP. Proper installation and physical location of each duct detector and access door shall be coordinated between the electrical, the mechanical and the fire alarm sub-contractors and approved by the electrical and mechanical engineers prior to equipment installation.

a. Each Duct detector shall have a hinged duct access panel, 12 x 12 inches minimum for sampling tube inspection and cleaning. Indicate airflow direction on the duct adjacent to detector using permanent decal.

b. Duct detector sampling tubes shall extend the full width of the duct. Sampling tubes over 36 inches long must be provided with far end support for stability. Install sampling tube per manufacturer's instructions.

c. All duct detectors shall be programmed for alarm.

5. Remote annunciator Indicator Lights (RAIL): RAILs shall be provided for initiating devices where indicated on the plans. RAILs shall be provided with a key type switch for testing of the annunciated device. All RAILs shall be 24 VDC.

6. Addressable Pull Stations - General: Addressable pull stations shall, on command from the Control Panel, send data to the panel representing the state of the manual switch. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key. All pull stations shall be dual-action, have a positive, visual indication of operation and utilize a key type reset. The Glass-break rods are not allowed.

K Notification Appliances:

1. Speakers: Speakers located outdoors or in damp or wet locations shall be listed for use in wet locations. Electric speakers shall operate with synchronized audible output and have the following specifications: .

a. Voltage: Programmable electronic speakers shall operate on dual voltage 24/70 VRMS nominal.

b. Ceiling speakers: 8” round, field selectable taps 1/8 to 8 watts.
c. Ceiling speaker/strobes: 8” round, field selectable taps 1/8 to 8 watts, field selectable candela settings 15-177 CD
d. Cluster speakers/strobe: equal to Cooper Wheelock Series STH or equal.
e. Wall Mounted Speakers: Selectable taps 1/8 to 8 watts, frequency response 400-4000Hz and low current design, when used in exterior application provide as weatherproof.
f. Speakers shall be tapped to meet intelligibility criteria meeting average DB requirements of 15DB above ambient for each space. The adjustments shall also meet the Acoustically Distinguished Space (ADS) measurement STI/CIS range (good-excellent).
g. Programming: Electronic speakers shall be field programmable without the use of special tools. Speakers shall be adjustable from 0.25 to 2.0 Watts.
h. Provide 1 extra.

2. Speakers: : Speakers, where provided, shall have audible sound with taps at 1/4 watt, 1/2 watt, 1 watt, 2 watt. Speakers shall operate at 24V. Provide back boxes for all speakers. Speakers shall be tapped at 1 watt for design purposes.
   a. Provide 1 extra.
3. Strobes: shall be located as shown on the Drawings and provided per the requirements of the NCSBC chapter #11 and ICC A117.1-2009. Strobe lights indicated for use exterior to the building shall be mounted at the indicated elevation and listed for use in wet locations. Strobe lights shall operate with synchronized flash output and have the following specifications:
   a. Voltage: Strobe lights shall operate on 24 VDC nominal.
   b. Maximum pulse duration: 2/10ths of one second.
   c. Strobe intensity and flash rate: Must meet minimum requirements of UL 1971. Provide strobe lights with minimum intensity Candela (Cd) rating of 15/75 Cd, or greater if shown otherwise on drawings.
4. Audible/Visual Combination Devices shall comply with all applicable requirements for both Programmable Electronic Sounders and Strobe Lights.
5. Bells shall be 10” diameter vibrating type located as shown on the Drawings; bells located outdoors shall be listed for use in wet locations. Bells shall have the following specifications:
   a. Voltage: Bells shall operate on 120 V normal.

L Miscellaneous System Items

1. Addressable Dry Contact Monitor Module: Addressable Monitor Modules shall be provided to connect one supervised zone of non-addressable Alarm Initiating Devices (any Normally Open [N.O.] dry contact device) to one of the Fire Alarm Control Panel Signaling Line Circuit Loops. Monitor modules shall be installed as required by the system configuration. All required monitor modules may not be shown on the Drawings.
   a. Indication of Operation: An LED shall be provided that shall flash under normal conditions, indicating that the Monitor Module is operational and in regular communication with the control panel.
   b. Supervision: Unless specifically noted otherwise on the drawings provide one monitor module for each sprinkler switch.
2. Two Wire Detector Monitor Module: Addressable Monitor Modules shall be provided to connect one supervised IDC zone, Class A or alarm initiating devices (any N.O. dry contact device) to one of the Fire Alarm Control Panel Signaling Line Circuit Loops. Monitor modules shall be installed as required by the system configuration. All required monitor modules may not be shown on the Drawings. Indication of Operation: Unless otherwise indicated on the Drawings an LED shall be provided that shall flash under normal conditions, indicating that the Monitor Module is operational and in regular communication with the control panel.
3. Addressable Control Module: Addressable Control Modules shall be provided to supervise and control the operation of one conventional Notification Appliance Circuit (NAC) of compatible, 24 VDC powered, polarized Audio/Visual (A/V) Notification Appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contract relay. The control module

shall provide address-setting means using DIP switches and shall also store an internal identifying code that the control panel shall use to identify the type of device. An LED shall be provided that shall flash under normal conditions, indicating that the control module is operational and is in regular communication with the control panel.

a. Configuration: The control module NAC circuit may be wired for Class B with up to 1 Amp of inductive A/V signal, or 2 Amps of resistive A/V signal operation, or as a dry contact (Form C) relay. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.
b. Power Source: Audio/visual power shall be provided by a separate supervised power loop from the main fire alarm control panel or from a supervised, 3rd party listed remote power supply. AN power sources and connections are not shown on the Drawings
c. Test Switch: A magnetic test switch shall be provided to test the module without opening or shorting its NAC wiring.

4. Isolator Module: Isolator Modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop. The Isolator Module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC Loop. Modules must be readily accessible (not above ceiling) and clearly labeled.
   a. Operation: Isolator Modules shall operate such that if a wire-to-wire short occurs, the Isolator module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the Isolator Module shall automatically reconnect the isolated section. The Isolator Module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an Isolator Module after its normal operation.
   b. The Isolator Modules shall provide a single LED that shall flash to indicate that the Isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.
   c. Isolation modules must be provided in the following locations as a minimum.
      1) Immediately adjacent to the Main Fire Alarm Control Unit, at each end of the addressable loop. These two isolators must be within 15 feet of the Main Fire Alarm Control Unit.
      2) After each 20 initiating devices and control points on the addressable loop.
      3) For loops with 20 or less control points install isolation module in approximately the middle of the loop.
      4) Near the point where any addressable loop extends outside the building envelope.
      5) For loops covering more than one floor where addressable loop crosses between floors.
   d. Each isolation module must be clearly labeled, readily accessible for convenient inspection.
5. Water Flow Switch: Flow switches shall be integral, mechanical, non-coded, non-accumulative retard type. Flow switches shall have an alarm transmission delay time that is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds. Flow switches shall be located a minimum of one (1) foot from a fitting that changes the direction of the flow and a minimum of three (3) feet from a valve as required per NFPA 13. Installation: Water Flow Switches shall be connected by the Division 26 (Electrical) Contractor but furnished and installed by the Division 23 (Mechanical) Contractor.
6. Sprinkler and Standpipe Valve Supervisory Switch: Supervisory switch mechanisms shall be contained in a weatherproof housing that shall provide a 3/4 inch tapped conduit entrance and shall incorporate the necessary facilities for attachment to the valves. Switch housing shall be finished in red baked enamel. Mounting: Mount switch so as not to interfere with the normal operation of the valve and adjust to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.
7. Remote Annunciator Indicator Lights (RAIL): RAILs shall be provided with a key type switch for testing of the annunciated device. In addition, RAILs shall have the following features: Voltage: RAILs shall operate on 24 VDC nominal.
8. Door Hold-Open magnets:

a. Door hold open magnets shall be suitable for mounting in a single gang electrical device box.
b. Door hold open magnets shall be furnished with keepers, door chains, and other accessories as required to properly hold open doors as indicated on the Drawings.
c. Wall mounted magnetic door holders and separate heavy duty closers shall be used instead of combination door control units.
d. Holding force of the magnet shall be appropriate for the door to be held open. Door hold open magnets shall operate in a fail safe manner, i.e., the door shall release in event of a failure of voltage to the device.
e. Power Source: Door hold open magnets shall be configured to operate from a nominal 24 VDC system as supplied by the FACP or other power supply listed for the purpose.
f. All hold open magnet supply sources, whether a part of the FACP or whether derived from a separate power supply, shall be supervised.
g. Door hold open magnet circuits which use step-down transformers, 120 VAC, or local relays are not permitted.
h. Door shall close after 60 seconds of the power loss.

9. Battery Power Supply (BPS) &/or Supplementary Notification Appliance Circuit (SNAC): These types of panels shall be completely maintenance free, shall not require liquids, fluid level checks or refilling, and shall not be capable of producing spills and/or leaks. Batteries shall be sealed gel-cell type with expected life of 10 years. Battery voltage shall be as required by the FACP and related equipment. Battery shall have sufficient capacity to power the fire alarm system for not less than 60 hours plus 15 minutes of alarm upon a normal AC power failure. Battery cabinet shall be twice the size of the batteries it will contain. NAC circuits shall not exceed 75% of maximum current load allowed.
   a. The voltage drop at EOL must not exceed 14% of the expected battery voltage after the required standby and alarm times. Determine worst case voltage at far end of each NAC circuit. The results must not be than the minimum listed rating on the device.
   b. Where voltage drop or capacity limits are exceeded provide additional NAC panels as required for a fully functional system.
   c. All power supplies shall be capable of withstanding prolonged short circuits in the field wiring, either line-to-line or line-to-ground, without damage.
   d. All power supplies shall be equipped with battery charging using dual-rate charging techniques for fast battery recharge.
10. Voice Amplifier Cabinets
   a. Provide voice amplifier cabinets as identified on plans and as need to support the number of devices shown on the drawings. All amplifier cabinets shall be UL listed to operate with the system provided. Amplifier cabinets shall work in conjunction with the NAC panels and control panels to form a complete system.
   b. Provide a minimum of 25% spare amplifier capacity for future growth.
11. Enclosure: All equipment enclosures shall be third party listed suitable for surface or semi-flush mounting. Cabinet and front shall be corrosion resistant, given a rust-resistant prime coat, and manufacturer's standard finish. The door shall provide a key lock and a glass opening for viewing indicators. Door hinge shall be field selectable (left or right).

M Wiring

1. Addressable loop (signaling line) circuits shall be wired with type FPL/FPLR/FPLP fire alarm cable, AWG 18 minimum, low capacitance, twisted shielded copper pair. Cable shield drain wires are to be connected at each device on the loop to maintain continuity, taped to insulate from ground, and terminated at the FACP. Acceptable cables include Atlas 228-18-1-1STP, BSCC S1802s19 (same as EEC 7806LC), West Penn D975, D991 (AWG 16), D995 (AWG 14), or equal wire having capacitance of 30pf/ft. maximum between conductors. Belden 5320FJ acceptable if only FPL rating needed.
   a. Unshielded cable, otherwise equal to the above, is permitted to be used if the manufacturer’s installation manual requires, or states preference for, unshielded cable.
   b. In underground conduit, use Type TC or PLTC cable (PE insulated) to avoid problems from moisture.

c. The following conductor color coding shall be maintained throughout the system:
   1) Initiating Circuits: Red (+)/White (-)
   2) Initiating Circuits, Smoke Only: Violet (+)/Grey (-)
   3) Signal Line Circuits: Red jacket with Red (+)/Black(-)
   4) Alarm Indicating Appliance Circuits: Blue (+)/Black(-)
   5) AHU Shutdown Circuits: Yellow (+)/Brown (-)
   6) Door Control Circuits: Orange
   7) Elevator Capture Circuits: Brown

2. All voice signal cabling shall be a minimum of #18 AWG twisted shielded pair cable. The shield shall be continuously connected from the amplifiers to the end of line.
3. Supervision must be provided between individual addressable modules and their associated contact type initiating devices.

N Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
1. For each AC power circuit that interfaces with fire alarm equipment install an AC suppressor in a listed enclosure near the electrical panelboard, and trim excess lead lengths. Wind small coil in the branch circuit conductor just downstream of the suppressor connection. Coil to be 5 to 10 turns, about 1" diameter, and securely tie-wrapped. This series impedance will improve the effectiveness of the suppressor in clipping fast rise time voltage transients.
2. Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350 V(ac), line-to-neutral, and 350 V(ac), line-to-line; do not use fuses.
3. Initiating Device Circuits, Notification Appliance Circuits, and Communications Circuits: Provide surge protection at each point where circuit exits or enters a building; rated to protect applicable equipment; for 24 V(dc) maximum dc clamping voltage of 36 V(dc), line-to-ground, and 72 V(dc), line-to-line.
4. On DC circuits extending outside the building: Provide surge protection at each point where circuit exits or enters a building, rated to protect applicable equipment.

O Locks and Keys: Deliver keys to Owner.
1. Provide the same standard lock and key for each key operated switch and lockable panel and cabinet; provide 5 keys of each type

P Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
2. Provide one for each control unit where operations are to be performed.
3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
4. Provide extra copy with operation and maintenance data submittal.

Q SPARE PARTS:
1. The following spare parts shall be provided with the system. For multi-building projects, calculate quantities separately for each building that contains a dedicated fire alarm control panel. If FACP also serves auxiliary buildings (e.g., storage, boiler/chiller), calculate as if one building. Increase decimal quantities to the next higher whole number.

| | | |
|---|---|---|
| a. | • Fuses (If Used) | 2 of each size in system |
| b. | Manual Fire Alarm Boxes | 2% of installed quantity |
| c. | Addressable Control Relays | 4% of installed quantity |
| d. | • Indoor Horns/Speakers with Strobes Lights | 4% of installed quantity |
| e. | Indoor Strobe-only Notification Appliances | 4% of installed quantity |
| f. | Monitor Modules (Addressable Interface) | 4% of installed quantity |
| g. | Isolation Modules I Isolation Bases | 4% of installed quantity |
| h. | Addressable, Electronic Heat Detectors | 4% of installed quantity |
| i. | • Spot-Type Smoke Detectors I Sounder Bases | 6% of installed quantity |
| j. | * No spares are required for projected beam, air sampling, or duct smoke detectors | |

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A Install in accordance with applicable codes, NFPA 72, NFPA 70, and the contract documents.

B Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

C All equipment supplied must be specifically listed for its intended use and shall be installed in accordance with the manufactures recommendations. The contractor shall consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation. Contractor shall refer to the Riser/Connection diagram for all specific system installation/termination/wiring data.

D All system components shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load. Adhesives are not permitted to mount fire alarm system components to building surfaces or structure.

E The system shall be electrically supervised for open or ground fault conditions in SLC, alarm, voice, and control circuits. Removal of any detection device, alarm appliance, plug-in relay, system module, or standby battery connection shall also result in a trouble signal.

F When programming the system, activate the automatic drift compensation feature for all spot- type smoke detectors. Systems with alarm verification are not to have this feature activated without written direction from the owner's representative or the AHJ. Alarm verification must not be used with multi-sensor/multi-criteria detectors under any circumstances, as inadequate system response may result. Most applications of analog addressable smoke detectors do not require alarm verification to reduce nuisance alarms, as they are better able to discriminate between fire and common non-fire ambient events. A short operational test with normal occupancy can determine if transient ambient events are a problem

G Provide photoelectric smoke detector within 15 feet of every Fire Alarm Control Panel, NAC Panel or other fire alarm control equipment. These detectors shall be provided weather shown on plans or not.

H Set spot-type smoke detector sensitivities to normal/medium, unless directed otherwise by the design engineer/owner's rep. High sensitivity may be appropriate in relatively benign, clean environments such as art museums and libraries, to improve system response time without causing nuisance alarms.

I Unless suitably protected against dust and other debris, spot type smoke detectors shall not be installed until final construction clean-up has been completed. In the even that detectors are damaged during construction due to failure to adequately protect devices, they shall be replaced by the contractor at no expense to the owner.

J Print a complete System Status and Programming Report after the above steps have been done. This must include the program settings for each alarm initiating device and the current sensitivity of each analog addressable smoke detector.

K Install instruction cards and labels.

L Basic operating instructions shall be framed and permanently mounted at the Main Control Unit. The NFPA 72 record of completion must either be kept at the Main Control Unit or an alternate location may be permanently engraved at the Main Control Unit.

M Provide engraved label at the Main Control Unit and secondary power supplies identifying the 120V power source including panelboard location, panelboard identifier, and branch circuit number.

N Breaker serving fire alarm power supplies shall be protected with a fire alarm handle lock, Space Age Electronics ELOCK series or approved equal. Additionally the breaker handle shall be labeled with 1/4" permanent red dot.

O Identification of individual initiating devices is required. Assign each initiating device a unique number as follows, sequence starting from the FACP: (Addressable Loop # -- Device #). Show device numbers on as built plans and permanently mark each detector base so that it is readable on the floor below without having to remove detector. Labels must be typewritten with black lettering and clear background.

**3.02 CONDUIT AND WIRING**

A All fire alarm system wiring shall be in metal conduit, minimum 3/4", or surface metal raceway. All fire alarm system raceway, couplers, and connectors must meet performance and installation requirements as identified in other sections of this specification manual.

B Detection or alarm circuits must not be included in raceways containing AC power or AC control wiring. Within the Fire Alarm Control Panels, and 120V control wiring or other circuits must with an externally supplied voltage above 24 V must be properly separated from other circuits and have the appropriate warning label to alert service personnel to the potential hazard.

C There shall be no splices in the system other than at device terminal blocks, or on terminal blocks in cabinets.

D Permanent wire markers shall be used to identify all connections in the Main Fire Alarm Control Unit and other control equipment, at power supplies and terminal cabinets.

E In multistory buildings, all circuits leaving the riser on each floor shall feed through a labeled terminal block in a hinged enclosure accessible from the floor.

F All wiring terminal block screws shall have pressure wire connectors of the self-lifting or box lug type.

G All wiring shall be checked for grounds, opens, and shorts, prior to termination at panels and installation of detector heads. The minimum allowed resistance to ground between any two conductors shall be 10 megohms, as verified with an insulation resistance test. Provide Engineer with the results of these tests.

H The exterior of all junction boxes, including both sides of covers, containing fire alarm conductors shall be painted red. Box interior shall not be painted.

I Box covers shall be labeled to indicate the circuit(s) or function of the conductors contained within. Labels shall be neatly applied black lettering on clear background. Handwritten labels or embossed tape labels are not allowed.

J All conduits penetrating exterior walls must have internal sealing to prevent condensation from infiltrating humid air.

**3.03 INSPECTION AND TESTING FOR COMPLETION**

A Notify Owner 7 days prior to beginning completion inspections and tests.

B Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

E Provide all tools, software, and supplies required to accomplish inspection and testing.

F Upon completion of the installation the Contractor and the Manufacturer’s authorized installer together shall conduct a 100% performance test of each and every alarm initiating device for proper response. The system shall operate for 48 hours prior to start of test. The Contractor shall be present for the full 100% test.

G The A/E and owner must be given 7 days advance notice of the tests. All Audio Visual Device Testing shall be scheduled with the owner.

H 100% Test: The manufacturer or authorized distributor (by definition, “installer”) must 100% test all site-specific software functions for the system and then provide a detailed report or check list showing the system’s operational matrix. This documentation must be part of the “System Status and Programming Report”.

1. Upon completion of the installation and its programming, the installer’s technician shall test every alarm initiating device for proper response and indication, and all alarm notification appliances for effectiveness. Also, in coordination with the other building system contractors, all other system functions shall be verified, including (where applicable) elevator capture and the control of HVAC systems, door locks, pressurization fans, fire or smoke doors/dampers/shutters, etc. The engineer must be notified in advance of these 100% tests, to permit witnessing them if desired.
2. If AHU shutdown occurs for any alarm, then the matrix would indicate the specific control relay(s) for that function being commanded to operate for alarm from any initiating device. If a rolling steel fire door is to drop only upon waterflow alarm from its sprinkler zone, or upon any two spot smoke detectors in adjacent spaces being simultaneously in alarm, the matrix would show the door’s control relay activating upon alarm from the applicable waterflow switch(es), or from any two smoke detectors in the selected spaces (AND gate).
3. The digital communicator shall be on-line and tested for proper communication to the receiving station.

4. All supervised circuits must also be tested to verify proper supervision. (Control circuits and remote annunciation lines are among those required to be supervised.)
5. All testing described above shall be repeated in the event that subsequent software or wiring modifications are determined necessary to meet the requirements of the contract documents. Such re-testing shall be included as part of the base bid and provided at no additional cost to the Owner.

I Test Documentation: The installer must fill out and submit the following documentation to the owner, through the engineer, prior to the AHJ's system acceptance inspection:

1. Written verification that this 100% system test was done with copy of print out generated during test.
2. The NFPA 72, "Record of Completion" Form. Use this form (no substitutes) to detail the system installation and also to certify that: (a.) It was done per Code, and (b.) The Code- required 100% test was performed. The fire alarm installer (manufacturer or authorized distributor's technician) must sign this form. If a representative of the AHJ, owner, or engineer witnesses the tests, in whole or in part, they must also sign the form to signify that fact only (annotating the form as needed to clarify their limited role).
3. For buildings with a smoke control or smoke purge system, an HVAC balance report, in the smoke control / smoke purge mode.
4. The System Status and Programming Report described in NFPA 72. This must be generated on the day of the system acceptance inspection and shall include the measured sensitivity of each smoke detector.
5. The purpose of doing Item above on the day of the inspection is to assure detector sensitivity has not been affected by construction dust. Prudent contractors will have taken measures to prevent detector contamination during construction, and will also have had the system do a detector sensitivity test and printout prior to the day of the inspection, to make certain all devices are properly programmed and operating within their limits.

J After completion of the 100% system test and submission of documentation as described above the installer is to request the engineer to set up an inspection. The system must operate for at least two days prior to this inspection The responding Fire Department shall be notified of this, for pre-fire planning purposes. On local government projects, local fire authorities may also want to participate in system acceptance inspections. However, for State-owned property they have no inspection jurisdiction and, if present, are only to observe.

K PRE-FINAL INSPECTION: At the Owner's request and after passing the Designer's pre-final inspection, the Contractor and Manufacturer's authorized installer will conduct system test in the presence of the Owner and the Designer.

L FINAL INSPECTION: The fire alarm system will be inspected, with portions of it functionally tested. This will normally include the use of appropriate means to simulate smoke for testing detectors, as well as functionally testing the system interface with building controls, fire extinguishing systems and any off-premises supervising station. Operation of any smoke removal system will be checked as instructed by the AHJ. This statistical (sampling) inspection is intended to assure that the contractor has properly installed the system and performed the 100% operational test as required by NFPA 72. The electrical contractor shall provide two-way radios, ladders, and any other materials needed for testing the system, including a suitable smoke source.

1. Smoke control and smoke management systems are normally tested by measuring air flow rates and pressure differentials, plus observing any effect the system has on the operation of exit, elevator, and stairway doors. Testing with smoke "bombs" (smoke candles) is NOT appropriate because they produce cold chemical smoke that lacks buoyancy and, therefore, does not rise like the smoke from a fire.
2. The test will be conducted entirely by the Contractor. A copy of the final database software must be presented to the Owner before this test. The software shall be loaded from these disks into the system in the presence of the Owner. The review will then be conducted using this software. Any deficiencies shall be recorded and corrected. After the items have been corrected, the system shall be tested again.
    a. In the event of malfunctions or excessive nuisance alarms, the Contractor must take prompt corrective action. The Owner may require a repeat of the Contractor's 100% system test, or other inspections.

b. Test Report: Upon successful completion of the Inspection and after the correction of all efficiencies, the manufacturer's authorized representative shall issue a test report to the Engineer and Owner, detailing and certifying the test.
c. System Acceptance: After successful completion of the Final Inspection and recommendation of the Engineer, the system will be accepted by the Owner. At this time the warranty period begins.

**3.04 OWNER PERSONNEL INSTRUCTION**

A Provide the following instruction to designated Owner personnel:
1. Hands-On Instruction: On-site, using operational system.
2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.

B Maintenance Technicians: Detailed training for electrical technicians, on programming, maintaining, repairing, and modifying; factory training:
1. Initial Training: Minimum of 8 hours of instruction, pre-closeout.
a. Training shall cover at a minimum the following:
1) Preventative maintenance service techniques and schedules, including historical data trending of alarm and trouble records.
2) Overall system concepts, capabilities, and functions. Training shall be in depth, so that owner shall be able to take any device out of service and return any device to service without the need of manufacturer's approval or assistance.
3) Explanation of all control functions, including training to program and operate the software.
4) Methods and means of troubleshooting and replacement of all field wired devices.
5) Methods and procedures for trouble shooting the main fire alarm control panel, including field peripheral devices as to programming, bussing systems, internal panel and unit wiring, circuitry, and interconnections.
6) Manuals, drawings, and technical documentation. Actual system software used for training shall be provided in digital form and shall be left with the Owner at the completion of the training for the Owner's use in the future.

C Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

D Provide two copies of bound training summary to be referenced by owner's maintenance staff in the future.

**3.05 CLOSEOUT**

A Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
1. Be prepared to conduct any of the required tests.
2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
3. Have authorized technical representative of control unit manufacturer present during demonstration.
4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
5. Repeat demonstration until successful.

B Occupancy of the project will not occur prior to Project Acceptance.

C Project Acceptance of the project cannot be achieved until inspection and testing is successful and:
1. Approved operating and maintenance data has been delivered.
2. Spare parts, extra materials, and tools have been delivered.
3. All aspects of operation have been demonstrated to Owner.
4. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
5. Occupancy permit has been granted.
6. Specified pre-closeout instruction is complete.

**3.06 MAINTENANCE**

A Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
3. Record keeping required by NFPA 72 and authorities having jurisdiction.

B The manufacturer must maintain software version records on the system installed. The system software shall be upgraded free of charge if a new version is released during the warranty period.

C Provide trouble call-back service upon notification by Owner:
1. Provide on-site response within 2 hours of notification.
2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

D Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

E Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.

F Comply with Owner's requirements for access to facility and security.

**END OF SECTION 28 46 01**

# SECTION 31 1000 - SITE CLEARING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

### 1.2 SUMMARY

A. This Section includes the following:

1. Protection of existing trees.
2. Clearing and grubbing.
3. Removal of trees and other vegetation.
4. Topsoil stripping.

### 1.3 DEFINITIONS

A. Remove: Remove and legally dispose of items indicated. Removal includes digging out and off-site disposing of stumps and roots or burning if allowed by local ordinance

B. Tree Protection Zone: The area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

C. Topsoil: Friable, clay loam surface soil, found in varying depths.

### 1.4 MATERIALS OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

### 1.5 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees, plantings and other improvements adjoining the construction that might be misconstrued as damage caused by the Work.

### 1.6 PROJECT CONDITIONS

A. Traffic: Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.

B. Protection of Existing Improvements: Provide protections necessary to prevent damage to existing improvements indicated to remain in place.

1. Protect existing improvements on adjoining properties and on Owner's property.
2. Restore existing improvements damaged by clearing operations to their original condition.

C. The conditions existing at the time of inspection for bidding purposes will be maintained by the Owner to the extent practical. However, minor variations may occur due to natural occurrences prior to the start of clearing work.

D. Do not commence site-clearing operations until erosion and sedimentation control measures are in place.

## PART 2 - PRODUCTS

### 2.1 TREE PROTECTION FENCING

A. Tree protection fencing shall be non tearable orange "snow fence" of 2,000 lb. tensile yield per 4 ft. width and 1,000% elongation at break complying with ASTM D638.

## PART 3 – EXECUTION

### 3.1 PROTECTION OF EXISTING TREES AND VEGETATION

A. Install tree protection fencing as indicated. Erect and maintain a temporary fence around the drip line of individual trees or around the perimeter drip line of groups of trees to remain.

1. Do not store construction materials, debris, topsoil or other excavated material within the tree protection zone.
2. Do not permit vehicles or other equipment within the tree protection zone.
3. Maintain tree protection zones free of weeds and trash.

B. Protect existing trees and other vegetation indicated to remain in place, against unnecessary cutting, breaking or skinning of roots, skinning or bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line.

C. Provide protection for roots over 1-1/2 inch diameter that are cut during construction operations. Coat cut faces with emulsified asphalt, or other acceptable coating, formulated for use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.

D. Repair or replace trees and vegetation indicated to remain which are damaged by construction operations, in a manner acceptable to Architect.

### 3.2 SITE CLEARING

A. General: Remove trees, shrubs, grass and other vegetation as required to permit installation of the Work. Cut minor roots and branches of trees indicated to remain in a clean and careful manner, where such roots and branches obstruct installation of the Work.

B. Clearing and Grubbing: Clear site of trees, shrubs and other vegetation within the clearing limits indicated.

1. Completely remove stumps, roots, and other debris.
2. Use only hand methods for grubbing inside drip line of trees indicated to remain.
3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated. Place fill material in horizontal layers not exceeding 6 inches loose depth, and thoroughly compact to a density equal to adjacent original ground.

C. Selective Clearing: Clear areas designated as "Selective Clearing" of all ground covers, underbrush and trees less than 6-inches in diameter at breast height. Coordinate extent of material removed with Architect.

1. Remove trees that appear to be dying or weakening for any reason and at any point during construction up to and including Substantial Completion at the Architect's direction.

## 3.3 TOPSOIL STRIPPING

A. Remove heavy growths of grass from areas before stripping.

B. Strip topsoil to whatever depths are encountered, but to a minimum of at least 4 inches.

C. Strip topsoil in a manner to prevent intermingling with underlying subsoil or other material.

1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

D. Where existing trees are indicated to remain, leave existing topsoil in place within drip lines to prevent damage to root system.

E. Temporarily stockpile topsoil in storage piles in areas indicated or directed. Construct storage piles to provide free drainage of surface water. Cover storage piles, if required, to prevent wind erosion.

1. Do not stockpile topsoil within tree protection zones.

2. Stockpile surplus topsoil to allow for respreading deeper topsoil.

F. Dispose of unsuitable or excess topsoil in a legal manner off-site.

## 3.4 DISPOSAL OF WASTE MATERIALS

A. Burning on Owner's Property: Burning may be allowed on this site subject to approval from the local Fire Marshall and other authorities having jurisdiction. Comply with all conditions of the burn permit, if it is obtained.

B. Removal from Owner's Property: Remove waste materials generated by clearing operations from Owner's property and dispose of in a legal manner off-site.

1. Remove waste materials and debris from the site in a manner to prevent spillage. Pavements and the area adjacent to the site shall remain free from mud, dirt and debris at all times.

2. Clean up debris resulting from site clearing operations continuously with the progress of the work.

END OF SECTION 31 1000

SECTION 31 2000 - EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

B. Refer to Section 01 2110 and the Bid Form for information concerning required allowances and unit prices.

C. Refer to Section 31 1000 for topsoil stripping and Section 32 9200 for topsoil placement.

1.2 SUMMARY

A. This Section includes the following:

1. Excavation, filling, backfilling, and grading indicated and necessary for proper completion of the work.
2. Preparing of subgrade for building slabs, walks, and pavements.
3. Drainage/porous fill course for support of building slabs.
4. Excavating and backfilling of trenches.
5. Excavating and backfilling for underground mechanical and electrical utilities and buried mechanical and electrical appurtenances.
6. Providing and monitoring settlement plates.

1.3 SUBMITTALS

A. NCDOT approved Job Mix for stone.

B. Imported fill (if required): Submit location of borrow pit and a sample of the soil for approval to the Owner's Geotechnical Engineer a minimum of fourteen (14) working days prior to use

C. Geotextile Fabric

D. Copy of Blasting Permit, approved by authorities having jurisdiction, for record purposes.

1.4 DEFINITIONS

A. Excavation: Removal of all material (except for rock) encountered to design subgrade elevations indicated for cut areas and to subsoil elevations in fill areas. Excavation also includes subsequent respreading, moisture conditioning, compaction, and grading of satisfactory materials removed.

B. Unauthorized Excavation: Removal of materials beyond the limits indicated in the definition of "Excavation" without specific direction of Architect.

C. Additional Excavation: Removal, disposal and replacement of materials beyond the limits indicated in the definition of "Excavation" at the direction of the Architect. Refer to Part 3 of this Section for requirements of Additional Excavation.

D. Subgrade: The undisturbed earth (in cut) or the compacted soil layer (in fill) immediately below granular subbase, drainage fill, or topsoil materials.

E. Subsoil: The undisturbed earth immediately below the existing topsoil layer.

F. Building Pad: The area extending 10 feet beyond the exterior limits of the building/column footings and down to undisturbed soils at a one horizontal to one vertical slope.

G. Structures: The area extending a minimum of ten (10) feet beyond the edge of foundations, slabs, curbs, underground tanks, piping or other man-made stationary features occurring above or below ground surface.

H. Pavements: The area extending 10 feet beyond the exterior limits of paved areas and down to undisturbed soils at a one horizontal to one vertical slope. The area extending 3 feet beyond the exterior limits of walks and down to undisturbed soils at a one horizontal to one vertical slope

I. Subbase Material: Artificially graded mixture of crushed gravel or crushed stone meeting NCDOT specifications. Material type is indicated on the drawings.

J. Drainage/Porous Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel meeting the requirements of NCDOT No. 57 Stone.

K. Rock: Hard bed rock, boulders or similar material requiring the use of rock drills and/or explosives for removal. The criteria for classification of general excavation as rock is any material which cannot be dislodged by a Caterpillar D-8 Tractor, or equivalent, equipped with a single tooth hydraulically operated power ripper. The criteria for trench rock shall be that a Caterpillar 345 Backhoe, or equivalent, with a proper width bucket cannot remove the material.

## 1.5 ADDITIONAL WORK

A. Paragraph 4.3.4 of General Conditions refers to certain conditions that may require additional excavation work. This paragraph is further defined herein and, where there are conflicts, is superseded by this section.

B. Claims for concealed, unknown, or unanticipated subsurface conditions are limited to those circumstances where:

1. Additional excavation work is required below the contract limits indicated to provide acceptable bearing for building pad, structures or pavements.

2. Additional excavation work is required to raise, lower, or revise the footings, foundations or other parts of the building to provide acceptable bearing.

3. Additional excavation work below the utility trench design elevations, for utilities outside the limits of the building, as required to provide acceptable bearing for the utility.

4. Rock is encountered between existing grade and design subgrade.

C. The risks of concealed, unknown, or unanticipated subsurface conditions (except for rock) from existing ground surface to the design subgrade elevations in cut areas and to subsoil elevations in fill areas shall be included in the Contract Amount and shall not be considered as grounds for additional costs to the Contract. The risks of concealed, unknown, or unanticipated subsurface conditions <u>below</u> the elevations stated above shall be considered as Additional Excavation.

D. During construction, if concealed, unknown, or unanticipated subsurface conditions are encountered which require that footings, foundations or other parts of the building be raised, lowered or revised to provide acceptable bearing for the building or if, outside the building limits, additional depth of utility trench excavation below the design subgrade or subsoil elevations is required, immediately notify the Architect upon discovery of such condition prior to disturbing the material encountered.

E. Payment for additional Work

1. Additional excavation shall be counted toward the unit price allowances established in the Bid Form. *The Owner reserves the right to negotiate said unit price allowances prior to the Award of Contract.*

2. Lowering of footings shall be paid for at a negotiated amount. The additional excavation involved shall be counted toward the unit price allowance.

3. Rock removal, if required, shall be counted toward the unit price allowances established in the Bid Form. All rock removal required to complete work other than trenching shall be paid for at the unit price for mass rock removal. Rock payment lines are limited to the following:

a) Two feet outside of concrete work for which forms are required, except footings.

b) One foot outside perimeter of footings, two feet below bottom of footings.

c) In pipe trenches, 6 inches below invert elevation of pipe and 3 feet wider than outside diameter of pipe, but not less than 4 feet minimum trench width.

d) Outside dimensions of concrete work where no forms are required.

e) Under slabs on grade, 6 inches below bottom of concrete slab.

4. No payment will be made for unauthorized excavation.

5. The expense of surveying quantities of rock removal and additional excavation shall be included in the unit price allowances.

1.6 EARTHWORK BALANCE ADJUSTMENTS

A. Adjustments of grades may be allowed with prior written approval of the Architect in order to accommodate shortfall or surplus of material that may occur. Should adjustments be allowed, maintenance of designed drainage patterns and required adjustments to drainage structures shall be a Contract responsibility. **No additional payment will be made for these adjustments**.

B. It is anticipated that some material will be required to be imported to achieve the finish grades indicated on the Drawings. Importation of the required material shall be a Contract responsibility. **No additional payment will be made for the importation of this material**.

C. It is anticipated that some material will be required to be exported to achieve the finish grades indicated on the Drawings. Excavation and disposal of the required material off-site in a legal manner shall be a Contract responsibility. **No additional payment will be made for the export and disposal of this material**.

1.7 QUALITY ASSURANCE

A. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

B. Environmental Compliance:

1. Comply with the requirements of the latest edition of the North Carolina Erosion and Sediment Control Planning and Design Manual for erosion control during earthwork operations.

2. Comply with the permit conditions for all work performed within wetlands.

C. Testing and Inspection Service: Owner will employ and pay for an independent Geotechnical testing and inspection laboratory to perform soil testing and inspection service during earthwork operations. Cooperate with Owner's Geotechnical Engineer as required for testing and inspection of work. These services do not relieve the responsibility for compliance with Contract Document requirements.

1.8 PROJECT CONDITIONS

A. Site Information: Data concerning subsurface materials or conditions, which are based on test borings, have been obtained by the Owner for his use in designing the project. This data is contained in a report titled **GEOTECHNICAL ENGINEERING REPORT, Northwoods Park Middle School Addition" by ECS Southeast, LLP, dated May 24, 2023**. This report is included in this project manual for information only.

1. The accuracy or completeness of the data is not warranted or guaranteed by the Owner or the Architect/Engineer, and in no event shall be considered part of the Contract Documents. The Owner and Architect/Engineer expressly disclaim any responsibility for the data as being representative of the conditions and materials that may be encountered.

B. Bidders and interested parties (prior to receipt of bids) are encouraged to conduct their own soil and subsurface investigations, examinations, tests, and exploratory borings to determine the nature of the soil conditions underlying the project site. Contact the Owner's office to make an appointment to enter the site for the purpose of conducting your own investigation prior to bid.

C. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner of others except when permitted under the following conditions and then only after arranging to provide acceptable temporary utility services.

1. Notify Architect not less than 48 hours in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without receiving Architect's written permission.

3. Existing utilities across or along the line of work are indicated only in an approximate location. Locate all underground lines and structures. Call "NC one call" at 1-800-632-4949 prior to construction. If utilities are marked that are not shown on the plans, locate utility vertically and horizontally and provide information to architect. Repair and correct any damage to underground lines and structures.

1.9 SAFETY

A. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

1. Operate warning lights as recommended by authorities having jurisdiction and governing regulations and standards.

2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Work within the road right-of-way shall meet all requirements of the latest edition of the North Carolina Department of Transportation Work Area Protection Manual.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups CL, GC, SC, GW, GP, GM, SM, SW, and SP.

B. Unsatisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups CH, OL, OH, MH, ML and PT.

C. Backfill and Fill Materials: Satisfactory soil materials free of clay, rock or gravel larger than 4 inches in any dimension (2 inches for material used in trench backfill), debris, waste, frozen materials, vegetation and other deleterious matter.

D. Imported material for structural fill shall comply with ASTM D2487 soil classification groups CL, GC, SC, GW, GP, GM, SM, SW, and SP.

2.2 ACCESSORIES

A. Non-woven Geotextile Fabric (for drainage): Mirafi 140N, or equivalent.

B. Woven Geotextile Fabric (for reinforcement): Mirafi 500X, or equivalent.

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 earthwork operations.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Section 02230 "Site Clearing."

C. Protect and maintain erosion and sedimentation controls during earthwork operations.

3.2 DEWATERING

A. Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area.

1. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrade and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or runoff areas. Do not use utility trench excavations as temporary drainage ditches.

B. Should any springs or running water be encountered in the excavation, notify the Architect and provide discharge by trenches (or other acceptable means) and drain to an appropriate point of disposal. Provide temporary drainage facilities to minimize the flow of rainwater onto adjacent property. Repair any damage to property or to subgrade as a result of construction and/or dewatering (or lack thereof) operations at no additional cost to the Contract. If permanent provision must be made for disposal of water other than as indicated, the Contract price shall be adjusted.

3.3 EXPLOSIVES

A. Blasting may be done only if authorized by the Owner and local authorities having jurisdiction. When explosives are used, experienced powdermen or persons who are licensed or otherwise authorized to use explosives shall execute the work. Explosives shall be stored, handled, and used in accordance with local regulations and with the “Manual of Accident Prevention in Construction” of the Associated General Contractor of America, Inc. Correct any damage to foundations or other work caused by use of explosives. Meeting the requirements of the blasting permit, if issued, is a Contract responsibility.

3.4 EXCAVATION

A. Excavation consists of removal, placement and disposal of material encountered when establishing required subgrade or finish grade elevations.

1. Excavation includes removal and disposal of pavements and other obstructions visible on ground surface; underground structures, utilities and other items indicated to be demolished and removed; together with earth and other materials encountered that are not classified as rock or unauthorized excavation.

B. Rock Excavation: If Rock is encountered the Owner’s Geotechnical Engineer will verify that the material qualifies for classification as rock excavation.

1. If rock is encountered in grading, remove to depths as follows:

a) Under surfaced areas, to 6” under the respective subgrade for such areas.

b) Under grass and planted areas - 12" minimum.

c) Under footings – Two feet below bottom of footing, One foot outside of perimeter of footing.

d) Under trenches – 6" below bottom of trench.

2. After the Owner's Geotechnical Engineer verified that the material is rock, Contractor shall employ a surveyor licensed in the State of North Carolina to calculate the quantity of material removed as Rock Excavation. The quantity of rock calculated shall not exceed the volume determined by the payment limits. The Owner's Project Representative shall review the quantity calculated within 48 hours of receiving the survey notes.

## 3.5 EXCAVATION FOR BUILDING PAD AND STRUCTURES

A. Conform to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction and for review.

B. Excavations for footings and foundations: Do not disturb bottoms of excavation. Excavate by hand to elevations required just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.

1. Where rock is encountered, carry excavation to required elevations and backfill with crushed stone prior to installation of footing.

C. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Structures: Conform to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, other construction and for review. Do not disturb bottom of excavations intended for bearing surface.

## 3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Cut surface under pavements to comply with cross-sections, elevations and grades as indicated.

## 3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches of clearance on both sides of pipe or conduit.

B. Excavate trenches to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

1. Where rock is encountered, carry excavation to required elevations and backfill with NCDOT #57 crushed stone prior to installation of pipe.

2. For pipes or conduit less than 6 inches in nominal size, and for flat-bottomed, multiple-duct conduit units, do not excavate beyond indicated depths. Hand-excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.

3. For pipes and equipment 6 inches or larger in nominal size, shape bottom of trench to fit bottom of pipe for 90 degrees (bottom 1/4 of the circumference). Fill depressions with tamped sand backfill. At each pipe joint, dig bell holes to relieve pipe bell of loads ensure continuous bearing of pipe barrel on bearing surface.

## 3.8 EXCAVATION STABILITY

A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.

B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.

## 3.9 SUBGRADE INSPECTION

A. Notify Architect when mass, trench and footing excavations have reached required subgrade. The Architect will arrange for an inspection of conditions by the Owner's Geotechnical Engineer. *Alternative procedures for arranging this review may be implemented at the Owner's written option*.

B. If the Owner's Geotechnical Engineer determines that the subgrade bearing conditions are unacceptable, the Architect will authorize additional excavation until suitable bearing conditions are encountered.

C. Proof-roll subgrade [**below the building slabs and pavements**] <**Insert locations**> with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction[**, repeating proof-rolling in direction perpendicular to first direction**]. Limit vehicle speed to 3 mph (5 km/h).

2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).

3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Under supervision of the Owner's Geotechnical Engineer, proofroll subgrade in cut areas below the building pad and pavement(s) with a loaded dump truck or other approved pneumatic tired vehicle. Should any unstable sub-soil be encountered below pavement or structures, break up the top eight inches of ground surface, pulverize, moisture-condition to optimum moisture content, and compact to percentage of maximum density as stated in Percentage of Maximum Density Requirements. Perform this work at no additional cost and/or time to the Contract.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

## 3.10 ADDITIONAL EXCAVATION

A. Additional Excavation (Mass): Remove excavated materials and dispose of on-site as directed by the Architect. Replace this excavated material with satisfactory material placed and compacted according to the requirements of the "Placement and Compaction" section.

B. Additional Excavation in Trenches: Remove excavated materials and dispose of on-site as directed by the Architect. Replace this excavated material with stone.

C. Additional Excavation in Footings: Remove excavated materials and dispose of on-site as directed by the Architect. Replace this excavated material with lean concrete/flowable fill or with stone extending 12 inches laterally beyond the footing in all directions.

D. The quantity of material removed as Additional Excavation (Mass, Trench or Footing) shall be calculated by a surveyor licensed in the State of North Carolinaand employed by the Contractor. The Owner's Project Representative shall review the quantity calculated within 48 hours of receiving the survey notes.

E. Protect the subgrade during construction. During wet conditions, the subgrade soils may become saturated and soften, possibly resulting in damage to the subgrade if disturbed by equipment. Correct subgrade

damaged in this manner. **No additional payment will be made to correct subgrade damaged in this manner**.

## 3.11 UNAUTHORIZED EXCAVATION

A. Correct Unauthorized Excavation as follows:

1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position when acceptable to Architect.
2. Elsewhere, backfill and compact unauthorized excavations as indicated for authorized excavations of same classification unless otherwise directed by Architect.

## 3.12 STORAGE OF EXCAVATED MATERIALS

A. Temporarily stockpile excavated materials acceptable for use as backfill and fill. Place, grade, and shape stockpiles for proper drainage. Cover to prevent windblown dust.

1. Stockpile excavated materials away from edge of excavations. Do not store within the drip line of trees to remain.

## 3.13 BACKFILL AND FILL

A. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance by local authority having jurisdiction of construction below finished grade, including perimeter insulation.
2. Review, approval, and recording of the locations of underground utilities.
3. Removal of concrete formwork.
4. Removal of shoring and bracing (including backfilling of voids with satisfactory materials).
5. Removal of trash and debris from excavation.
6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow or ice.

C. Ground Surface Preparation: Remove vegetation, debris, obstructions, and deleterious materials from ground surface prior to placement of fills.

D. Bench sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material. Plow, scarify, bench or break up sloped surfaces flatter than 1 vertical to 4 horizontal so fill material will bond with existing material.

E. Place soil material in layers to required subgrade elevations, for each area classification listed below, using materials indicated in Part 2 of this Section.

1. Under grassed areas, use satisfactory excavated or borrow material.
2. Under walks, curbs, and pavements, use satisfactory excavated or borrow material.
3. Under building slabs, use satisfactory excavated or borrow materials and drainage/porous fill material as indicated.

## 3.14 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and that are carried below bottom of such footings or that pass under wall footings. Place concrete to level of bottom of adjacent footing.

D. Provide 4-inch- (100-mm-) thick, concrete-base slab support for piping or conduit less than 30 inches (750 mm) below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches (100 mm) of concrete before backfilling or placing roadway subbase.

E. Place and compact initial backfill of [**subbase material**] [**satisfactory soil**], free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the utility pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches (300 mm) over the utility pipe or conduit.

G. Backfill voids with satisfactory soil while installing and removing shoring and bracing.

H. Place and compact final backfill of satisfactory soil to final subgrade elevation.

I. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

J. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

K. Do not backfill trenches until any required testing and inspections have been completed and Architect authorizes backfilling. Backfill carefully to avoid damage or displacement of pipe systems.

L. Under piping and conduit and equipment, use crushed stone where required over rock bearing surface and for correction of unauthorized excavation. Shape excavation bottom to fit bottom 90 degrees of cylinder.

M. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

## 3.15 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 3 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 3 percent and is too wet to compact to specified dry unit weight.

B. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations. Maintain the moisture content of the structural fill materials to within 3% of the optimum moisture content until permanently covered.

C. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to required density.

1. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

2. Work wet materials as directed by the Owner's Geotechnical Engineer. Base bids on working material daily for a maximum of five days of acceptable weather.
3. No additional payment will be made for these operations.

## 3.16 COMPACTION OF SOIL BACKFILL AND FILLS

A. Place backfill and fill 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. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

C. Control soil and fill compaction, providing minimum percentage of density indicated for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Architect if soil density tests indicate inadequate compaction.

D. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density at a moisture content within 3% of optimum in accordance with ASTM D698:

1. Under structures and building pad, compact each layer of backfill or fill soils to 95 percent maximum density of the Standard Proctor with moisture +/-3% of optimum moisture. The final lift should be compacted to a min of 98% of the Standard Proctor with moisture +/-3% of optimum moisture. This includes ground under future expansion areas.
2. For roadways the fill soils should be placed in in 10-12 inch loose lifts and compacted to a min of 95% of the standard proctor with moisture +/-3% of optimum moisture. The final lift of fill soils should be compacted to a min of 100% of the Standard Proctor. Crushed aggregate base coarse (CABC) should be placed in 10 to 12 inch compacted lifts and compacted to 100% of the Modified Proctor. CABC should be moisture condition prior to compacting and allow CABC to cure a min of 18-24 hours prior to proofrolling and density testing in the warmer months. During cooling months curing of CABC may take longer.
3. Under grass or unpaved areas, compact each layer of backfill or fill material at 92 percent maximum density of the Standard Proctor with moisture +/-3% of optimum moisture.

E. Seal all fill areas at the end of each working day, utilizing a smooth drum roller.

## 3.17 GRADING

A. General: Rough grading of areas within the Project, including cut and fill sections and adjacent transition areas, shall be reasonably smooth, compacted and free from irregular surface changes. The degree of finish shall be that ordinarily obtainable from either blade-grader or motor patrol except as otherwise indicated. The finished subgrade surface from the grassed areas generally shall be not more than 0.2 feet above or below the final grade or approved cross section, with due allowance for topsoil.

B. The tolerance for areas within 10 feet of building perimeter, walks and all areas to be paved shall not exceed 0.10 feet above or below the established subgrade. Finish all ditches, swales and gutters to drain readily. Unless otherwise indicated, evenly slope the subgrade to provide drainage away from building walls in all directions at a grade not less than ¼ inch per foot. Provide rounding at top and bottom of cut and fill slopes and at other breaks in grade.

C. Protection of Graded Areas: Protect newly graded areas and areas of cut, fill and design/subgrade elevations from the actions of the elements and from deterioration as a result of construction operations and weather conditions (frost, rains, snow, sleet, hail, etc.). Repair any settlement or washing that occurs prior to or after acceptance of the work. Fill to required subgrade levels any areas where settlement occurs. Protect trees to remain, and, at all areas of the Site where construction operations are in progress, provide protection for the safety of occupants of the existing facilities.

D. 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.

E. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus [**1 inch (25 mm)**] <**Insert tolerance**>.

2. Walks: Plus or minus [**1 inch (25 mm)**] <**Insert tolerance**>.

3. Pavements: Plus or minus [**1/2 inch (13 mm)**] <**Insert tolerance**>.

F. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.18 PAVEMENT SUBBASE COURSE:

A. General: Place subbase material, in layers of indicated thickness, over subgrade surface to support a pavement base course.

B. Grade Control: During construction, maintain lines and grades including crown and cross-slope of subbase course.

C. Shoulders: Place shoulders along edges of subbase course to prevent lateral movement. Construct shoulders of acceptable soil materials, placed in such quantity to compact to thickness of each subbase course layer. Compact and roll at least at 12” width of shoulder simultaneously with compacting and rolling each layer of subbase course.

D. Placing: Place subbase course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting subbase material during placement operations.

E. When a compacted subbase course is 6” thick or less, place material in a single layer. When more than 6” thick, place material in equal layers, except no single layer more than 6” or less than 3” in thickness when compacted.

F. Place subbase[ **and base**] course on subgrades free of mud, frost, snow, or ice.

G. On prepared subgrade, place subbase[ **and base**] course under pavements and walks as follows:

1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.

2. Place base course material over subbase course under hot-mix asphalt pavement.

3. Shape subbase[ **and base**] course to required crown elevations and cross-slope grades.

4. Place subbase[ **and base**] course 6 inches (150 mm) or less in compacted thickness in a single layer.

5. Place subbase[ **and base**] course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.

6. Compact subbase[ **and base**] course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than [**95**] <**Insert percentage**> percent of maximum dry unit weight according to [**ASTM D 698**] [**ASTM D 1557**].

H. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches (300 mm) wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than [**95**] <**Insert percentage**> percent of maximum dry unit weight according to [**ASTM D 698**] [**ASTM D 1557**].

3.19 BUILDING SLAB DRAINAGE COURSE

A. General: Place drainage/porous fill material, over subgrade surface to support concrete building slabs and sidewalks areas indicated.

B. Place drainage course on subgrades free of mud, frost, snow, or ice.

C. Placing: Place drainage/porous fill material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting material during placement operations.

D. When a compacted drainage course is indicated to be 6 inches thick or less, place material in a single layer. When indicated to be more than 6 inches thick, place material in equal layers, except no single layer more than 6 inches or less than 3 inches in thickness when compacted.

3.20 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction: Allow testing service to inspect and approve each subgrade and fill layer before further backfill or construction work is performed.

1. If in the opinion of the Architect, based on testing service reports and inspection, subgrade or fills have been placed that are below required density, perform additional compaction and testing until required density is obtained.

B. The Owner will engage, and pay for, the services of a Geotechnical Engineer whose function shall be to afford complete engineering control by testing of the conditions of all footing subgrades, the placement of all structural fills under structures, building pad and pavement areas, and all compaction where required, and to observe the proof rolling of the building pad and pavement areas.

C. The Owner's Geotechnical Engineer will be present as deemed necessary during all phases of the Work requiring filling, compaction operations or testing. The Geotechnical Engineer will provide the Architect with written certification that fill and compaction was completed with accepted materials in accordance with the Documents, and give a professional opinion regarding shrinkage or settlement of fill and safe load bearing capacity of fill.

D. Site Preparation and Proofrolling: The Owner's Geotechnical Engineer will determine if any additional excavation or in-place densification is necessary to prepare a subgrade for fill placement for slab or pavement support.

E. Fill Placement and Compaction: The Owner's Geotechnical Engineer will witness all fill operations and take sufficient in-place density tests to verify that the indicated degree of fill compaction is achieved. The Owner's Geotechnical Engineer will observe and approve borrow materials used and shall determine if their existing moisture contents are suitable/acceptable.

F. Footing Excavation Review: The Owner's Geotechnical Engineer will review the footing excavations for the building foundations. He will verify that the design bearing pressures are available and that no loose or soft areas exist beneath the bearing surfaces of the footing excavations.

G. The Owner's Geotechnical Engineer will submit two (2) copies each of his reports, recommendations and/or opinions to the Architect/Engineer and the Owner. Pertinent information will be provided to the Contractor as required.

3.21 EROSION CONTROL:

A. Provide erosion control methods in accordance with requirements of authorities having jurisdiction, the North CarolinaErosion and Sediment Control Handbook, and as indicated in the Contract Documents.

3.22 PROTECTION

A. Repair and reestablish grades in settled, eroded, and rutted areas to indicated tolerances.

B. Reconditioning Compacted Areas: Where subsequent construction operations or adverse weather disturbs completed compacted areas, scarify surface, reshape, and compact to required density prior to further construction.

C. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

D. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

E.

3.23 DISPOSAL OF WASTE MATERIALS

A. Removal from Owner's Property: Remove excess and/or waste materials, including trash and debris, and dispose of it off Owner's property in a legal manner.

B. Dispose of excess material and materials not acceptable for use as backfill or fill legally offsite.

C. Do not remove topsoil from site until it has been demonstrated to the Owner’s satisfaction that it is excess.

3.24 SETTLEMENT PLATES

A. Provide and monitor three settlement plates to evaluate the settlement occurring during and after fill placement. Locate the settlement plates as indicated on Drawing C3.2 or as recommended by the Owners Geotechnical Engineer.

B. Record the elevation of the top of the settlement plate daily until settlement has slowed to a point satisfactory to the Owners Geotechnical Engineer. Settlement plate readings shall be made to an accuracy of 0.01’ and shall be referenced to a benchmark well beyond the influence of the fill being placed and protected from construction equipment disturbance.

C. Take precautions to prevent damaging or disturbing the settlement plates during construction operations.

D. Providing, maintenance and monitoring of the settlement plates is part of the Work.

E. Base bids on a settlement period of 45 calendar days commencing at the time final subgrade elevations in the area are attained.

END OF SECTION 31 2000

SECTION 31 2500 - EROSION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The provisions of the Contract Documents apply to the work of this Section.

B. The North Carolina Erosion and Sediment Control Planning and Design Manual, latest edition.

1.2 SUMMARY

A. This Section includes the installation, maintenance and removal of erosion control measures required for prevention of sediment leaving the project site.

1.3 EROSION AND SEDIMENT CONTROL PERMIT

A. Prior to commencement of work, obtain a copy of the approved Erosion and Sediment Control Plan from the North Carolina Department of Environmental and Natural Resources (NCDENR).

B. Apply for the Land Disturbance Permit from the North Carolina Department of Environmental and Natural Resources (NCDENR).

C. Post Erosion and Sediment Control Bond per the requirements in the approved permit with the North Carolina Department of Environmental and Natural Resources (NCDENR).

D. Schedule a pre-construction conference on-site with the Architect and NCDENR Environmental Inspector. Hold this meeting prior to the start of any construction activities.

1.4 SUBMITTALS

A. Copies of the weekly Erosion Control Measure inspection reports. *These may be submitted at the monthly progress meetings*.

B. Sediment Fence

C. Safety Fence

1.5 PAYMENT PROCEDURES FOR EROSION CONTROL MEASURES

A. Establish a line item in the Schedule of Values for Erosion Control Maintenance. This line item shall represent a minimum of thirty percent (30%) of the total value of the erosion control for the project.

B. Erosion control maintenance will be paid on a monthly basis, following the satisfactory installation and maintenance of the erosion control measures.

PART 2 - PRODUCTS

2.1 EROSION CONTROL PRODUCTS:

A. Safety Fence

1. Four foot high non-tearable orange plastic.

2. Post appropriate warning signs along the Safety Fence.

B. Construction Entrance

1. Heavy-duty stone aggregate and filter fabric construction entrance, complying with the requirements of Section 6.06 of the North Carolina Erosion and Sediment Control Planning and Design Manual.
2. The water source for washing operations shall be the responsibility of the Contractor.

C. Sediment Fence

1. Synthetic filter fabric, complying with the requirements of Section 6.62 of the North Carolina Erosion and Sediment Control Planning and Design Manual.
2. Steel posts 1.33 lb/lf with a minimum length of 5 feet.

D. Wire Reinforced Silt Fence

1. Synthetic filter fabric, complying with the requirements of Section 6.62 of the North Carolina Erosion and Sediment Control Planning and Design Manual.
2. Steel posts 1.33 lb/lf with a minimum length of 5 feet.
3. Wire fence reinforcement shall be a minimum of 14-guage and have a maximum mesh spacing of six inches.

E. Storm Drain Inlet Protection

1. Hardware cloth and gravel inlet protection, complying with the requirements of Section 6.51 of the North Carolina Erosion and Sediment Control Planning and Design Manual.
2. Block and Gravel Curb Inlet Sediment Filter complying with the requirements of Section 6.52 of the North Carolina Erosion and Sediment Control Planning and Design Manual.

F. Culvert Inlet Protection

1. Rock pipe inlet protection, complying with Section 6.55 of the North Carolina Erosion and Sediment Control Planning and Design Manual.

G. Diversion Dike

1. A dike or dike channel constructed along the perimeter of a disturbed construction area, complying with Section 6.22 of the North Carolina Erosion and Sediment Control Planning and Design Manual.

H. Temporary Diversion

1. A temporary ridge or excavated channel or combination ridge and channel constructed across sloping land on a predetermined grade, complying with Section 6.20 of the North Carolina Erosion and Sediment Control Planning and Design Manual.

I. Permanent Diversion

1. A permanent ridge or channel or combination ridge and channel constructed on a designed grade across sloping land, complying with Section 6.21 of the North Carolina Erosion and Sediment Control Planning and Design Manual.

J. Temporary Sediment Trap

1. A small, temporary ponding basin formed by an embankment or excavation to capture sediment, complying with Section 6.60 of the North Carolina Erosion and Sediment Control Planning and Design Manual and to the details indicated on the Drawings.

K. Sediment Basin

1. An earthen embankment suitable located to capture sediment, complying with Section 6.61 of the North Carolina Erosion and Sediment Control Planning and Design Manual and to the details indicated on the Drawings.
2. The pond shall be constructed for use as a permanent stormwater management facility. Conversion of the pond from a temporary to a permanent facility is required. Refer to the Basin Conversion Narrative

on the drawings.

L. Temporary Slope Drain

1. A tubing or conduit extending temporarily from the top to the bottom of a cut or fill slope, complying with the requirements of Section 6.32 of the North Carolina Erosion and Sediment Control Planning and Design Manual.
2. Pipe shall be smooth lined polyethylene, complying with the requirements of ASTM F667 or AASHTO M294.

M. Outlet Protection

1. A structure designed to control erosion at the outlet of a channel or conduit, complying with Section 3.40.1 of the North Carolina Erosion and Sediment Control Planning and Design Manual.

N. Riprap

1. A layer of stone designed to protect and stabilize areas subject to erosion, complying with Section 6.15 of the North Carolina Erosion and Sediment Control Planning and Design Manual.
2. The size of the stone required is indicated on the drawings.

O. Check Dam

1. A small temporary stone dam constructed across a drainage way, complying with the requirements of Section 6.83.1 of the North Carolina Erosion and Sediment Control Planning and Design Manual.
2. Check dams shall be placed on filter fabric.

P. Dewatering Structure

1. A temporary filtering device used for dewatering operations, complying with the requirements of Sections 6.62 and 6.65 of the North Carolina Erosion and Sediment Control Planning and Design Manual.

Q. Temporary Seeding

1. Planting rapid growing annual grasses, small grains or legumes to provide initial temporary cover for erosion control on disturbed areas, complying with Section 6.10 of the North Carolina Erosion and Sediment Control Planning and Design Manual.

R. Permanent Seeding

1. Refer to Section 32 9200 “Lawns and Grasses” for permanent seeding requirements.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF EROSION CONTROL MEASURES

A. Install all erosion and sediment control measures per the requirements of the North Carolina Erosion and Sediment Control Planning and Design Manual.

B. Protect all points of construction ingress and egress to the site to prevent tracking of mud onto public streets. Provide temporary construction entrances at all points of access to the site.

C. Clear only those areas necessary for installation of the perimeter erosion control measures. The balance of the site shall not be cleared or otherwise disturbed until the perimeter erosion control measures are installed, functional and approved by the NCDENR Environmental Inspector.

D. Follow the construction sequence and install erosion control measures as indicated on the Drawings and as directed by the NCDENR Environmental Inspector.

E. Install additional measures as necessary to prevent sediment from leaving the project site.

3.2 MAINTENANCE OF EROSION CONTROL MEASURES

A. Maintain all erosion and sediment control measures per the requirements of the North Carolina Erosion and Sediment Control Planning and Design Manual.

B. At a minimum, the following maintenance is required:

1. Safety Fence

a) Review fence regularly for damage. Repair any damage immediately.

b) Secure the fence at the end of each working day. Repair or replace all locking devices as necessary.

2. Construction Entrance

a) Wash and rework stone and/or place additional stone as required to prevent tracking of mud onto the roadways.

b) Clean out the sediment-trapping device for the washrack.

c) Remove all materials spilled, dropped, washed or otherwise tracked onto roadways or into storm sewers immediately. Do not use water trucks to wash the roadways.

3. Sediment Fence

a) Inspect immediately following each rainfall and at least daily during prolonged rainfall.

b) Make any required repairs immediately. Give special attention to damage resulting from end-runs and undercutting.

c) Replace fabric that is decomposing or is otherwise ineffective.

d) Clean out accumulated sediment following every storm event. Do not allow sediment to accumulate higher than one-half the height of the barrier.

4. Wire Reinforced Sediment Fence

a) Inspect immediately following each rainfall and at least daily during prolonged rainfall.

b) Make any required repairs immediately. Give special attention to damage resulting from end-runs and undercutting.

c) Replace fabric that is decomposing or is otherwise ineffective.

d) Clean out accumulated sediment following every storm event. Do not allow sediment to accumulate higher than one-half the height of the barrier.

5. Storm Drain Inlet Protection

a) Inspect immediately following each rainfall and at least daily during prolonged rainfall.

b) Remove and clean or replace stone filters that have been clogged with sediment. Make any required repairs immediately

c) Remove accumulated sediment as required. Do not allow sediment to accumulate higher than one-half the height of the measure.

6. Culvert Inlet Protection

a) Inspect immediately following each rainfall and at least daily during prolonged rainfall.

b) Remove and clean or replace stone filters that have been clogged with sediment. Make any required repairs immediately

c) Remove accumulated sediment as required. Do not allow sediment to accumulate higher than one-half the height of the measure.

7. Temporary Diversion Dike
    a) Inspect immediately following each rainfall and at least daily during prolonged rainfall. Inspect at least once every two weeks, whether or not it has rained. Make any necessary repairs immediately.
    b) Repair damages caused by construction activities by the end of each working day.
8. Temporary Diversion
    a) Review measure at the end of each working day to ensure its effective operation.
9. Diversion
    a) Inspect diversion following every rainfall and at least once every two weeks.
    b) Remove accumulated sediment and make repairs as necessary.
    c) Re-seed as necessary to maintain vegetative cover.
10. Temporary Sediment Trap
    a) Remove sediment and restore the trap to its original dimensions once the sediment accumulates to the cleanout level. Refer to the drawings for the appropriate cleanout level elevations.
    b) Any pumping shall be discharged through an approved dewatering structure.
    c) Remove and clean or replace stone choked with sediment.
    d) Regularly check the structure to ensure that it is structurally sound. Immediately repair any damage discovered.
11. Sediment Basin
    a) Remove sediment and restore the basin to its original dimensions once the sediment accumulates to the cleanout level. Refer to the drawings for the appropriate cleanout level elevations.
    b) Any pumping shall be discharged through an approved dewatering structure.
    c) Regularly inspect the principal spillway and outfall for proper function. Regularly inspect the emergency spillway to ensure that its lining is well established and erosion resistant. Immediately repair any damage discovered.
    d) Regularly check the embankment to ensure that it is structurally sound. Immediately repair any damage discovered.
12. Temporary Slope Drain
    a) Inspect the temporary slope drains weekly and following every storm event. Immediately make any necessary repairs to ensure a free flow through the pipe.
13. Outlet Protection
    a) Inspect outlet protection following every storm event. Re-lay riprap as necessary to prevent concentrated flow from running across the outlet protection.
14. Riprap
    a) Inspect riprap following every storm event. Re-lay riprap as necessary to prevent concentrated flow from running under or around the riprap.
    b) Clean out accumulated sediment from the riprap.
15. Check Dams
    a) Inspect immediately following each rainfall and at least daily during prolonged rainfall.
    b) Remove and clean or replace stone that has been clogged with sediment.
    c) Inspect for evidence of by-pass flows. Make any required repairs immediately

d) Remove accumulated sediment as required. Do not allow sediment to accumulate higher than one-half of the height of the dam.

16. Dewatering Structure

a) Repair or replace the filtering media to prevent sediment accumulation from affecting the filtering capacity of the structure.

17. Temporary Seeding

a) Re-seed and mulch areas where cover is inadequate to protect against erosion until adequate cover is obtained.

C. Remove accumulated sediment as required and at appropriate intervals to maintain the effective function of all erosion control measures.

D. Inspect, repair and remove accumulated sediment from erosion control measures following significant (greater than ½") rainfall events.

E. If erosion control measures become clogged, causing the impoundment of water, restore the measures immediately. Ponded water poses a potential drowning hazard and shall be relieved immediately by either pumping (through an approved dewatering structure) or by removal of the blockage.

## 3.3 REMOVAL OF EROSION CONTROL MEASURES

A. Remove all temporary erosion control measures following the stabilization of the site. Do not remove erosion control measures until authorized by the NCDENR Environmental Inspector.

B. Topsoil, permanently seed and stabilize areas occupied by erosion control measures.

END OF SECTION 31 2500

# SECTION 31 31 16 - TERMITE CONTROL

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

A. This Section includes the following:
   1. Soil treatment with termiticide.

B. Related Sections include the following:
   1. Division 06 Section "Rough Carpentry" for wood preservative treatment by pressure process.
   2. Division 07 Section "Sheet Metal Flashing and Trim" for custom-fabricated metal termite shields.

### 1.3 PERFORMANCE REQUIREMENTS

A. Service Life of Soil Treatment: Soil treatment by use of a termiticide that is effective for not less than five years against infestation of subterranean termites.

### 1.4 SUBMITTALS

A. Product Data: For termiticide.
   1. Include the EPA-Registered Label and NC Department of Agreiculture Label for **termiticide** products.

B. Product Certificates: For termite control products, signed by product manufacturer.

C. Qualification Data: For Installer of termite control products.

D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following:
   1. Date and time of application.
   2. Moisture content of soil before application.
   3. Brand name and manufacturer of termiticide.
   4. Quantity of undiluted termiticide used.
   5. Dilutions, methods, volumes, and rates of application used.
   6. Areas of application.
   7. Water source for application.

E. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located. Installer must be located within 25 miles of the project site.

B. Regulatory Requirements: Formulate and apply termiticides according to the EPA-Registered Label, State of North Carolina Department of Agriculture and other authorities having jurisdiction.

C. Source Limitations: Obtain termite control products through one source.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination" to schedule application of termiticide products.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

1.7 COORDINATION

A. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

B. Apply borate treatment after framing, sheathing, and exterior weather protection is completed but before electrical and mechanical systems are installed.

C. Install bait-station monitoring system during construction to determine areas of termite activity.

D. Install bait-station system after construction, including landscaping, is completed.

1.8 WARRANTY

A. General Warranty: Special warranty 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. Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.
1. Warranty Period: Five years from date of Final Completion.

1.9 MAINTENANCE SERVICE

A. Continuing Service: Beginning at Substantial Completion, provide 12 months' continuing service including monitoring, inspection, and re-treatment for occurrences of termite activity. Provide a standard continuing service agreement. State services, obligations, conditions, and terms for agreement period; and terms for future renewal options. Installer shall be located within 25 miles of the project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Termiticides:
a. Aventis Environmental Science USA LP; Termidor.
b. Bayer Corporation; Premise 75.
c. Dow AgroSciences LLC;
d. FMC Corporation, Agricultural Products Group.
e. Syngenta; Demon TC.

2.2 SOIL TREATMENT

A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control.
1. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.
   1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
   2. Foundations: Adjacent soil including soil along the entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating the slab, and around interior column footers, piers, and chimney bases; also along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
   3. Crawlspaces: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
   4. Masonry: Treat voids.
   5. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

**END OF SECTION 31 31 16**

SECTION 32 1216 - ASPHALT PAVEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hot-mix asphalt paving over prepared subbase.
2. Hot –mix asphalt patching.
3. Hot-mix asphalt overlays.
4. Asphalt surface treatments
    a) Coal tar sealant

1.3 SUBMITTALS

A. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

B. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

C. Traffic maintenance and Work Area Protection Plan: Submit a plan indicating sequencing and measures to be used for the maintenance and protection of traffic during operations within or immediately adjacent to existing roadways open to vehicular traffic. The Architect and the North Carolina Department of Transportation must approve this plan prior to commencement of work within the Right-of-Way.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed hot-mix asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Asphalt paving materials and installation shall conform to the requirements of the latest edition of the North Carolina Department of Transportation (NCDOT) Standard Specifications for Roads and Structures.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:

1. Tack Coats: Minimum ambient temperature of 50 deg F (10 deg C), and when temperature has not been below 35 deg F (1 deg C) for 12 hours immediately prior to application.
2. Asphalt Base Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.
3. Asphalt Surface Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.

1.6 TESTING AND INSPECTION

A. Within the road Right-of-Way and in the bus loop, NCDOT inspectors shall observe the asphalt placement. Coordinate the necessary inspection schedule with the local NCDOT District Office.

B. The Owner's testing agency will observe the asphalt placement in the parking lots and on-site areas not in Right-of-Way.

PART 2 - PRODUCTS

2.1 ASPHALT-AGGREGATE MIXTURE

A. General: Provide plant-mixed, hot-laid asphalt-aggregate mixture complying with the requirements of the NCDOT Standard Specifications for Roads and Structures and as recommended by local paving authorities to suit project conditions.

2.2 ASPHALT MATERIALS

A. Tack Coat: ASTM D 977, emulsified asphalt or ASTM D 2397, cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.

B. Prime Coat: Asphalt emulsion prime conforming to NCDOT requirements.

2.3 AUXILIARY MATERIALS

A. Paving Geotextile: Nonwoven polypropylene, specifically designed for paving applications, resistant to chemical attack, rot, and mildew.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.

B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

C. Notify Architect in writing of any unsatisfactory conditions. Do not begin paving installation until these conditions have been satisfactorily corrected.

3.2 MAINTENANCE AND PROTECTION OF TRAFFIC

A. Utilize flagmen, barricades, warning signs and warning lights as required by the NCDOT Roadway Standard Drawings and Standard Specifications for Roads and Structures.

3.3 PATCHING AND REPAIRS

A. Patching: Saw cut perimeter of patch and excavate existing pavement section to sound base. Recompact new subgrade. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically.

1. Tack coat faces of excavation and allow to cure before paving.

2. Fill excavation with dense-graded, hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.

B. Leveling Course: Install and compact leveling course consisting of dense-graded, hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch (25 mm) in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches (75 mm) thick.

C. Crack and Joint Filling: Remove existing filler material from cracks or joints to a depth of 1/4 inch (6 mm). Refill with asphalt joint-filling material to restore watertight condition. Remove excess filler that has accumulated near cracks or joints.

D. Tack Coat: Apply uniformly to existing surfaces of previously constructed asphalt or Portland cement concrete paving and to surfaces abutting or projecting into new, hot-mix asphalt pavement. Apply at a uniform rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m) of surface.

1. Allow tack coat to cure undisturbed before paving.

2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillage and clean affected surfaces.

## 3.4 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

C. Prime Coat: For asphalt sections less than 4” thick, apply uniformly over surface of compacted-aggregate base at a rate of 0.15 to 0.50 gal./sq. yd. (0.7 to 2.3 L/sq. m). Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure for 24 hours minimum.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use just enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.

2. Protect primed substrate from damage until ready to receive paving.

## 3.5 GEOTEXTILE INSTALLATION

A. Apply bond coat, consisting of asphalt cement, uniformly to existing surfaces at a rate of 0.20 to 0.30 gal./sq. yd. (0.8 to 1.2 L/sq. m).

B. Place paving geotextile promptly according to manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches (100 mm) and transverse joints 6 inches (150 mm).

1. Protect paving geotextile from traffic and other damage and place overlay paving the same day.

## 3.6 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt mix on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness, when compacted.

1. Place hot-mix asphalt base course in number of lifts and thickness indicated.

2. Spread mix at minimum temperature of 225 deg F (107 deg C).

B. Place paving in consecutive strips not less than 10 feet (3 m) wide, except where infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete asphalt base course for a section before placing intermediate or surface courses.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

## 3.7 JOINTS

A. Construct joints between old and new pavement, or between successive days work, to ensure continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat.
2. Offset longitudinal joints in successive courses a minimum of 6 inches (150 mm).
3. Offset transverse joints in successive courses a minimum of 24 inches (600 mm).
4. Construct transverse joints as required by the NCDOT Standard Specifications for Roads and Structures.
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.

## 3.8 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).

B. Breakdown Rolling: Accomplish breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Repair surfaces by loosening displaced material, filling with hot-mix asphalt, and rerolling to required elevations.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling, while hot-mix asphalt is still hot enough to achieve indicated density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 92 percent of reference laboratory density according to ASTM D 1559.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm. Surface course average density shall be 90 percent SF9.5A and 92 percent S9.5B of reference laboratory density.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method. Edges adjacent to curbs and curb and gutter sections shall be flush with the edge of concrete.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials. Remove paving course over area affected and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.9 INSTALLATION TOLERANCES

A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch (13 mm).
2. Surface Course: Plus 1/4 inch (6 mm), no minus.

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch (6 mm).
2. Surface Course: 3/16 inch (3 mm).
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

C. Check surface areas at intervals as directed by Architect.

3.10 ASPHALT PAVEMENT OVERLAY

A. Mill at edges in accordance with the NCDOT standards and detail on the plans.

3.11 FIELD QUALITY CONTROL

A. Within the NCDOT Right-of-Way and in the bus loop, coordinate required inspections with the local NCDOT District Office.

B. Testing Agency: Owner will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from requirements.

C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with requirements.

D. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with requirements.

END OF SECTION 32 1216

SECTION 32 1313 - SITE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 DESCRIPTION OF WORK:

A. Extent of Portland cement concrete paving is shown on drawings, including:

1. Curbs and gutters
2. Concrete Medians
3. Walkways
4. Service area pavement.
5. Paved Ditches

1.3 SUBMITTALS

A. Provide certification that all materials meet NCDOT standards for the class of concrete required.

1.4 JOB CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.

1. Use flexible spring steel forms or laminated boards to form radius bends as required.
2. Coat forms with a nonstaining form release agent that will not discolor or deface surface of concrete.

B. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A 185.

C. Reinforcing Steel: ASTM A 615, Grade 60, deformed

D. Concrete Materials: Comply with requirements of applicable Division 3 sections for concrete materials, admixtures, bonding materials, curing materials, and others as required.

E. Expansion Joint Materials: Comply with requirements of applicable Division 7 sections for preformed expansion joint fillers and sealers.

F. Antispalling Compound: Combination of boiled linseed oil and mineral spirits, complying with AASHTO M-233.

G. Liquid-Membrane Forming and Sealing Curing Compound: Comply with NCDOT Standard Specifications for Roads and Structures.

2.2 CONCRETE MIX, DESIGN, AND TESTING

A. Comply with requirements of applicable Division 3 sections for concrete mix design, sampling and testing, and quality control or NCDOT Standard Specifications for Roads and Structures whichever is more stringent.

B. Design mix to produce normal-weight concrete consisting of Portland cement, aggregate, water-reducing or high-range water-reducing admixture (superplasticizer), air-entraining admixture, and water to produce the following properties:

1. Comply with the requirements of NCDOT Standard Specifications for Roads and Structures, unless otherwise indicated.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

B. Proof-roll prepared subbase surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

3.2 FORM CONSTRUCTION

A. Set forms to required grades and lines, braced and secured. Install forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.

B. Check completed formwork for grade and alignment to following tolerances:

1. Top of forms not more than 1/8 inch in 10 feet.

2. Vertical face on longitudinal axis, not more than 1/4 inches in 10 feet.

C. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.

3.3 REINFORCEMENT

A. Locate, place and support reinforcement as specified in Division 3 sections, unless otherwise indicated.

3.4 CONCRETE PLACEMENT

A. General: Comply with requirements of applicable Division 3 sections for mixing and placing concrete or NCDOT Standard Specifications for Roads and Structures whichever is more stringent.

B. Do not place concrete until subbase and forms have been checked for line and grade. Moisten subbase if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

C. Place concrete by methods that prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.

D. Deposit and spread concrete in a continuous operation between transverse joints as far as possible. If interrupted for more than 1/2 hour, place a construction joint.

E. Fabricated Bar Mats: Keep mats clean and free from excessive rust, and handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

F. Place concrete in 2 operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.

G. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer or use bonding agent if acceptable to Architect.

H. Curbs and Gutters: Automatic machine may be used for curb and gutter placement. If machine placement is to be used, submit revised mix design and laboratory test results that meet or exceed minimums indicated. Machine placement must produce curbs and gutters to required cross-section, lines, grades, finish, and jointing as indicated for formed concrete. If results are not acceptable, remove and replace with formed concrete meeting requirements.

3.5 JOINTS

A. General: Construct expansion, weakened-plane (contraction), and construction joints true to line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.

B. Weakened-Plane (Contraction) Joints: Provide weakened-plane (contraction) joints, sectioning concrete into areas as shown on drawings. Construct weakened-plane joints for a depth equal to at least 1/4 concrete thickness, as follows:

1. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.

2. Sawed Joints: Form weakened-plane joints with powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded, or otherwise damaged by cutting action.

3. Inserts: Use embedded strips of metal or sealed wood to form weakened-plane joints. Set strips into plastic concrete and carefully remove strips after concrete has hardened.

C. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for more than 1/2 hour, except where such placements terminate at expansion joints.

1. Construct joints as indicated or, if not indicated, use standard metal keyway-section forms.

D. Expansion Joints: Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks, and other fixed objects, unless otherwise indicated.

E. Locate expansion joints at 20 feet o.c. for each pavement lane unless otherwise indicated.

F. Extend joint fillers full width and depth of joint, not less than 1/2 inch or more than 1 inch below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.

G. Provide joint fillers in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.

H. Protect top edge of joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.

I. Fillers and Sealants: Comply with requirements of applicable Division 7 sections for preparation of joints, materials, installation, and performance.

J. Refer to Drawings for scoring patterns for:

1. Selected sidewalk areas

3.6 CONCRETE FINISHING

A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

B. After floating, test surface for trueness with a 10-ft. straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

C. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2-inch radius, unless otherwise indicated. Eliminate tool marks on concrete surface.

D. After completion of floating and when excess moisture or surface sheen has disappeared, complete troweling and finish surface as follows:

1. Broom finish by drawing a fine-hair broom across concrete surface perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to Architect.

E. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Architect.

3.7 CURING

A. Protect and cure finished concrete paving in compliance with applicable requirements of Division 3 sections. Use membrane-forming curing and sealing compound or approved moist-curing methods.

3.8 REPAIRS AND PROTECTIONS

A. Repair or replace cracked, broken or defective concrete curbs and curb and gutter, as directed by Architect.

B. Replace cracked, broken or defective concrete sidewalks.

C. Repair or replace cracked, broken or defective concrete pavement, as directed by Architect.

D. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy adhesive.

E. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

F. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just before final inspection.

END OF SECTION 32 1313

# SECTION 32 1700 - PAVEMENT MARKINGS, SIGNS AND SPECIALTIES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

### 1.2 SUMMARY

A. This Section includes, but is not limited to, the following:

1. Establishing the location of pavement markings and applying pavement markings for parking space lines, traffic control, fire lane and accessible spaces.
2. Installation of signs for traffic control and accessible spaces.
3. Installation of wheel stops at parking spaces.

### 1.3 QUALITY ASSURANCE

A. All work and materials shall conform to the requirements of the latest edition of the Local Municipality and North Carolina Department of Transportation (NCDOT) Standard Specifications for Roads and Structures.

B. All materials for signs shall conform to the requirements of the latest edition of the Local Municipality and North Carolina Department of Transportation (NCDOT) Standard Specifications for Roads and Structures (and to the requirements of the latest edition of the Manual of Uniform Traffic Control Devices for traffic signs.

C. Installer Qualifications: Engage an experienced installer, who has successfully completed striping and signage projects similar in size and complexity to this project. The installer's primary business (defined as a minimum of 60% of total billings) shall be striping and signage.

### 1.4 SUBMITTALS

A. Product Data and written confirmation that the following materials are included on NCDOT's list of approved construction materials:

1. Pavement marking paint
2. Wheel stops
3. Signs
4. Posts

PART 2 - PRODUCTS

2.1 PAVEMENT MARKING PAINT

A. Paint shall conform to the requirements of Division 12 of the (NCDOT) Standard Specifications for Roads and Structures and Federal Specification TT-P-1952. Color shall be white unless otherwise indicated.

B. Curb painting color along fire lanes and cross walks shall be yellow, unless otherwise indicated.

C. Thermoplastic lane markings are required within NCDOT rights-of-way.

2.2 PAINT APPLICATOR

A. Provide hand-operated push-type applicator machine of a type commonly used for application of paint to pavement surfaces. Paint applicator machine shall be acceptable for marking small street and parking areas. Applicator machine shall be equipped with the necessary paint tanks and spraying nozzles, and shall be capable of applying paint uniformly at coverage specified.

2.3 WHEEL STOPS

A. Wheel stops shall be made of 3,000 psi precast concrete and be 6 inches high, 8 inches wide and approximately 6 feet long. Provide chamfered corners and edges and two holes for anchoring.

2.4 SIGNS AND POSTS

A. Signs shall conform to the requirements of Division 9 of the (NCDOT) Standard Specifications for Roads and Structures.

B. Signposts for traffic control signage shall be 4” x 4” treated wood conforming to the requirements of Division 10 of the (NCDOT) Standard Specifications for Roads and Structures.

C. Utilize metal posts for fire-lane signage and for signage at accessible parking spaces.

2.5 CONCRETE

A. Concrete shall be Class A, General concrete, conforming to the requirements of Division 10 of the (NCDOT) Standard Specifications for Roads and Structures.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION FOR PAVEMENT MARKING

A. Apply pavement markings only when the ambient temperatures is above 50°F and less than 95°F, unless otherwise approved.

B. Allow pavement to cure for a period of not less than 7 days before applying pavement marking.

C. Clean surfaces thoroughly before application of paint. Remove, dust, dirt and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods as required.

D. Remove existing pavement markings, residual curing compounds and other coating adhering to the pavement with scrapers, wire brushes, waterblasting, sandblasting or mechanical abrasion as required. Areas of existing pavement affected by oil or grease shall be scrubbed with an approved chemical and rinsed thoroughly. Seal oil soaked areas with shellac or primer after cleaning.

E. Pavement surfaces shall be dry and clean prior to painting. Pavement markings shall not be applied within 24 hours following rain or other inclement weather or when rain is imminent.

F. Apply seal coat across the existing pavement to provide a uniform surface appearance.

3.2 APPLICATION OF PAVEMENT MARKING

A. Apply paint in accordance with the requirements of Division 12 of the (NCDOT) Standard Specifications for Roads and Structures.

B. Lay out lines and markings to the width and length as indicated. All parking space lines shall be 4 inches wide.

C. Apply paint with an approved paint applicator.

D. Apply paint at manufacturer recommended rates to provide a minimum 15 mil wet thickness.

3.3 FIRE LANE MARKINGS AND SIGNAGE

A. Mark fire lanes and install fire lane signage in accordance with the requirements of the local Fire Marshall and as indicated on the drawings.

3.4 INSTALLATION OF WHEEL STOPS

A. Secure wheel stops with two 1/2-inch diameter steel reinforcing rods. Rods shall be a minimum of 18 inches in length and be embedded into the pavement, base and subgrade a minimum of 12 inches and be flush with the top of the bumper block.

3.5 INSTALLATION OF SIGNS

A. Install signs on signposts in accordance with the requirements of Division 9 of the (NCDOT) Standard Specifications for Roads and Structures.

B. Install signposts in concrete foundation to a depth of 3 feet minimum by 12 inches in diameter.

END OF SECTION 32 1700

SECTION 32 3113 - CHAIN-LINK FENCES AND GATES (GALVANIZED)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 WORK INCLUDED

A. Galvanized steel chain link fence and gates.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical data, and installation instruction for fencing, fabric, gates and accessories.

B. Shop Drawings: Submit shop drawings indicating location of fence (with dimensions), height, post locations, details of post installation, gate sing, hardware and accessories.

C. Samples: None required

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed chain-link fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Source Limitations for Chain-Link Fences and Gates: Obtain each color, grade, finish, type, and variety of component for chain-link fences and gates from one source with resources to provide chain-link fences and gates of consistent quality in appearance and physical properties.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates indicated in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. Galvanized Steel Fencing and Fabric:

a) Allied Tube and Conduit Corp.

b) American Chain Link Fence Company

c) American Tube Company

d) Anchor Fence, Inc.

e) Century Tube Corp.

f) Cyclone Fence Div./USX Corp.

2.2 FABRIC:

A. Steel Fabric: Comply with Chain Link Fence Manufacturers Institute (CLMFI) Product Manual. Provide one-piece fabric widths. Wire size includes zinc coating.

B. Size: 2-inch diamond mesh, 9-gauge (0.148-inch diameter) wire.

C. Galvanized Steel Finish: ASTM A 392, Class I, with not less than 1.2 oz. zinc per sq. ft. of uncoated wire surface.

D. Selvage shall be knuckled at the top and bottom.

2.3 FRAMING:

A. Strength requirements for posts and rails shall conform to ASTM F 669.

B. Pipe shall be straight, true to section, material and sizes specified.

C. Steel Framework, General: Posts, rails, braces and gate frames.

1. Type II Pipe: Manufactured from steel conforming to ASTM A 569 or A 446, grade D, cold formed, electric welded with minimum yield strength of 50,000 p.s.i. and triple coated with minimum 0.9 oz. Zinc per square foot after welding, a chromatic conversion coating and a clear polymer overcoat. Corrosion protection on inside surfaces shall protect the metal from corrosion when subjected to the salt spray test of ASTM B 117 for 300 hours with the end point of 5% Red Rust.

D. End, Corner and Pull Posts:

1. For fabric height up to 6’ - 2.375” OD Type II steel pipe (3.12 lb/ft). [2.875”, 73mm, 5.79 lb/ft.]

2. For fabric height over 6’ - 2.875” OD Type II steel pipe.(4.64 lb/ft). [4.00’, 101.6mm, 9.11 lb/ft]

E. Line Posts:

1. For fabric height up to 6’ - 1.90” OD Type II steel pipe (2.28 lb/ft).

2. For fabric height over 6’ - 2.375” OD Type II steel pipe (3.65 lb/ft).

F. Gate Posts:

1. Provide posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:

a) 6’ and Under: 2.875” OD Type II steel pipe (4.64lb/ft).

b) Over 6’: 4.000” OD Type II steel pipe (8.65 lb/ft).

G. Top & Bottom Rail:

1. Manufacturer’s longest lengths, with expansion-type couplings, approximately 6” long, for each joint. Provide means for attaching rail securely to each gate corner, pull, & end post.

a) Galvanized Steel: 1-1/4” NPS (1.66” OD) Type II steel pipe.

H. Intermediate and/or Center Rail:

1. Same material as top rail. Manufacturer’s standard galvanized steel cap required for each end.

2.4 FITTINGS AND ACCESSORIES:

A. Material: Comply with ASTM F 626. Mill finished galvanized steel, to suit manufacturer’s standards.

1. Zinc Coating: Unless specified otherwise, galvanize steel fence fittings and accessories in accordance with ASTM A 153, with zinc weights indicated.

B. Tension Wire: 7 gauge (0.177"diameter) metallic coated steel marcelled tension wire conforming to ASTM A 824 with finish to match fabric.

1. Type II Zinc Coated, Class 2, with a minimum coating weight of 1.2 oz. per sq. ft. of uncoated wire.

C. Wire Ties:

1. 9 gauge [0.148" (3.76mm)] galvanized steel wire for attachment of fabric to line posts.
2. Double wrap 13 gauge [0.092" (2.324mm)] for rails and braces.
3. Hog ring ties of 12-1/2 gauge [0.0985" (2.502mm)] for attachment of fabric to tension wire.

D. Post Brace Assembly:

1. Manufacturer's standard adjustable brace at end of gate posts and at both sides of corner and pull posts, with horizontal brace located at mid height of fabric. Provide same material as top rail for brace, and truss to line posts with 0.375" diameter rod and adjustable tightener. Manufacturer's standard galvanized steel cap required for each end.

E. Post and Line Caps: Weathertight closure cap required for each post. If top rail is required, use line post caps with loop.

F. Tension or Stretcher Bars: Hot-dip galvanized steel with minimum length 2" less than full height of fabric, minimum cross section of 3/16" by ¾" and minimum 1.2 oz. zinc coating per sq. ft. of surface area. One bar is required for each gate and end post and two for each corner and pull post, except where fabric is integrally woven into post.

G. Tension and Brace Bands: Minimum ¾" wide hot-dip galvanized steel with minimum 1.2 oz. zinc coating per sq. ft. of surface area.

1. Tension bands: Minimum 14 gauge (0.074") thick.
2. Tension and Brace bands: Minimum 12 gauge (0.105") thick.

H. Nuts and bolts shall be galvanized.

## 2.5 POST SETTING MATERIALS

A. Comply with the requirements for NCDOT Class A, 3000 psi concrete.

## 2.6 GATES:

A. Fabrication:

1. Fabricate perimeter frames of gates from metal and finish to match fence framework. Utilize fusion or stainless steel welded connections to form a rigid one-piece unit. Assemble gate frames by welding, providing security against removal or breakage of connections. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware and accessories. Space frame members maximum of 8' apart unless otherwise indicated.
2. Provide same fabric as for fence. Install fabric with stretcher bars at vertical edges and at top and bottom edges. Attach stretcher hooks to gate frame at not more than 15" o.c. Install diagonal cross-bracing consisting of 3/8" diameter adjustable length truss rods on gates to ensure frame rigidity without sag or twist.

B. Swing Gates: Comply with ASTM F 900.

1. Fabricate perimeter frames of minimum 1.90" OD Type II steel pipe.

C. Gate Hardware: Provide hardware and accessories for each gate, galvanized per ASTM A 153, and in accordance with the following:

1. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180 degrees gate opening. Provide 1-1/2 pair of hinges for each leaf over 6' nominal height.
2. Latch: Forked type to permit operation from either side of gate, with padlock eye as integral part of latch.
3. Keeper: Provide keeper that automatically engages gate leaf and holds it in open position until manually released.
4. Double Gates: Provide gate stops for double gates, consisting of mushroom type flush plate with anchors, set in concrete, and designed to engage center drop rod or plunger bar. Ensure plunger bar cannot be removed without tools. Include locking device and padlock eyes as integral part of latch, permitting both gate leaves to be locked with single padlock.
5. Hardware materials: hot dipped galvanized steel or malleable iron shapes to suit gate size.
6. Gate posts: Steel pipe ASTM F1083 standard weight schedule 40 minimum yield strength of 25,000 PSI size as indicated. Hot dipped galvanized with minimum 1.8 oz/ft² of zinc.

## PART 3 – EXECUTION

### 3.1 INSTALLATION:

A. General: Install fence in compliance with ASTM F 567 and manufacturers recommendations. Do not begin installation and erection before final grading is completed, unless otherwise permitted. Apply fabric to outside of framework, unless otherwise indicated.

B. Locate terminal post at each fence termination and change in horizontal or vertical direction of 30º or more, or as indicated on plans.

C. Excavation:

1. Drill or hand excavate (using post hole digger) holes for posts to diameters and spacing indicated, in firm, undisturbed or compacted soil.
2. Holes in asphalt or concrete surfaces will be cut by core-drilling with a bit of diameter at least equal to the required hole diameter. Holes in concrete may be formed prior to placing concrete.
3. Excavate holes for each post to minimum diameter recommended by fence manufacturer, but not less than 4 times largest cross-section of post.
4. Excavate hole to depths approximately 6" lower than post bottom, with bottom of posts set not less than 36" below finish grade surface.

D. Setting Posts:

1. Space 10' o.c. maximum, unless otherwise indicated.
2. Center and align posts in hole, 6" above bottom of excavation.
3. Protect portions of concrete posts above ground from concrete splatter. Place concrete around post and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.
4. Extend concrete above grade and slope all around (dome) to allow for drainage away from post. Uniformly and neatly texture the concrete surface with a broom finish. Remove any spilled or splashed concrete from the post and surrounding area immediately.

E. Top Rails:

1. Run rail continuously through line post caps, bending to radius for curved runs and at other posts terminating into rail end attached to posts or post caps fabricated to receive rail. Provide expansion couplings as recommended by fencing manufacturer.

F. Center Rails:

1. Install in one place between posts and flush with post on fabric side, using rail ends and special offset fittings where necessary. Install center rails on fence 12’ or taller, or as indicated on plans.

G. Bottom Rails:

1. Install in one piece between posts and flush with post on fabric side, using rail ends and special offset fittings when necessary.

H. Brace Assemblies:

1. Install braces so posts are plumb when diagonal rod is under proper tension.

I. Top and Bottom Tension Wire:

1. Install tension wires through post cap loops before stretching fabric and tie to each post cap with not less than same gauge and type of wire. Pull wire taut, without sags. Fasten fabric to tension wire, using 11 - ga. galvanized steel hog rings spaced maximum 24” o.c. Install where top and bottom rails are not specified on plans.

J. Fabric:

1. Leave approximately 2” between finish grade and bottom selvage. Pull fabric taut and tie to posts, rails and tension wires. Attach fabric with wire ties to line posts at 12”-15” (381mm) o.c. and to rails, braces, and tension wire at 24” (600 mm) o.c. Install fabric on security side of fence, unless otherwise indicated, and anchor to framework so that fabric remains in tension after pulling force is released.

2. For athletic field fencing, install fabric on the field side of the fence unless otherwise indicated.

K. Stretcher Bars:

1. Thread through fabric 4” o.c., and secure to end, corner, pull and gate posts with tension bands spaced maximum 15” o.c.

L. Accessories:

1. Tie Wires: Use U-shaped wire, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing.

2. Fasteners: Install nuts on side of fence opposite fabric side for added security.

M. Fasteners:

1. Install nuts for tension bands and hardware bolts on site of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

N. Gates:

1. Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.2 FINISHING

A. Remove and replace sections of damaged fence and fittings. Minor aesthetic damage may be touched up with a suitable spray on material.

B. Clean up debris and unused material and remove from the site.

END OF SECTION 32 3113

# SECTION 32 9200 - LAWNS AND GRASSES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

### 1.2 SUMMARY

A. This Section includes the following:

1. Fine grading and preparing lawn areas (including courtyards)
2. Topsoil Placement
3. Soil amendments
4. Fertilizers
5. Seeding
6. Hydroseeding

### 1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Lawns: All areas disturbed by construction and not otherwise covered by paving, buildings or other structures. Excluding athletic fields. (See Specification 02921)

### 1.4 SUBMITTALS

A. Certification by product manufacturer that the following products supplied comply with requirements:

1. Grass Seed

a) Certification of grass seed from seed vendor for each grass-seed mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

b) Blue tag certification for each bag of seed.

B. Installers qualifications

1. Provide a list, with references, of the past three projects of a similar magnitude.

C. Topsoil Amendment Plan.

1. Provide copy of topsoil testing report.
2. List of amendments proposed for topsoil, including application rates.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer, who has successfully completed lawn establishment projects similar in size and complexity to this project. The installer's primary business (defined as a minimum of 60% of total billings) shall be establishment of lawns.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Seed: Deliver seed in original sealed, labeled, and undamaged containers.

1.7 COORDINATION AND SCHEDULING

A. Planting Season: Sow lawn seed during normal planting seasons for type of lawn work required.
   1. Spring Planting Season:
      a) General Lawn Areas- Feb. 15- May 1
      b) Low-Maintenance Slope (3:1 or less)- Feb. 15- May 1
      c) Low-Maintenance Slope (Steeper than 3:1)- Feb. 15- May 1
   2. Fall Planting Season:
      a) General Lawn Areas- Aug. 15- Oct. 15
      b) Low-Maintenance Slope (3:1 or less)- Aug. 15- Oct. 15
      c) Low-Maintenance Slope (Steeper than 3:1)- Aug. 15- Oct. 15

B. Weather Limitations: Proceed with planting only when existing and forecast weather conditions are suitable for work.

C. Lawn Seeding Schedule
   1. Refer to the drawings for early seeding requirements for specified lawn areas.
   2. If job completion schedule does not allow seeding within a normal planting season, provide interim temporary seeding necessary to stabilize site. Complete permanent seeding during the next planting season.

1.8 LIMITS OF SEEDING

A. Spread topsoil and seed lawn areas. Hydroseed all slopes greater than 3:1.

1.9 PAYMENT PROCEDURES FOR LAWNS AND GRASSES

A. Establish a line item in the Schedule of Values for Lawn Maintenance. This line item shall represent a minimum of thirty percent (30%) of the total value of the seeding for the project.

B. Lawn maintenance will be paid on a monthly basis, following the satisfactory maintenance of the lawns.

PART 2 – PRODUCTS

2.1 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content; free of stones 1" or larger in any dimension and other extraneous materials harmful to plant growth.

1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

    a) Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from agricultural land, bogs or marshes.

B. Have topsoil tested by a certified soil testing laboratory to determine the type and quantity of soil amendments necessary. Add amendments to topsoil as necessary to meet these requirements.

## 2.2 INORGANIC SOIL AMENDMENTS

A. If the topsoil analysis indicates the need for inorganic soil amendments, the following standards apply:

B. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:

1. Class: Class O, with a minimum 95 percent passing through No. 8 (2.36-mm) sieve and a minimum 55 percent passing through No. 60 (0.25-mm) sieve.

2. Provide lime in form of dolomitic limestone.

C. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum 99 percent passing through No. 6 (3.35-mm) sieve and a maximum 10 percent passing through No. 40 (0.425-mm) sieve.

D. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

E. Aluminum Sulfate: Commercial grade, unadulterated.

F. Perlite: Horticultural perlite, soil amendment grade.

G. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.

H. Sand: Clean, washed, natural or manufactured, free of toxic materials.

I. Diatomaceous Earth: Calcined, diatomaceous earth, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

J. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

## 2.3 ORGANIC SOIL AMENDMENTS

A. If the topsoil analysis indicates the need for organic soil amendments, the following standards apply:

B. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 3/4-inch (19-mm) sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 percent of dry weight.

2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

3. Peat: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.

4. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.

5. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.4 HERBICIDES

A. Selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application.

2.5 FERTILIZER

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 20 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in topsoil analysis reports from a qualified soil-testing agency.

2. Minimum Composition: No less than 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

2.6 SEED

A. Grass Seed: All grass seed must be fresh, clean, and dry.

B. Seed Species

1. General Lawn Areas

| Proportion by Weight | Grass Species | Min. % Germination | Min. % Pure Seed | Max. % Weed Seed |
|---|---|---|---|---|
| 10% | 2 Types: Kentucky bluegrass (Poa pratensis). | 80 | 85 | 0.50 |
| 90% | 2 Types:Tall Fescue (Festuca arundinacea). | 85 | 98 | 0.50 |

2. Low-Maintenance Slope (3:1 or less)-Refer to Erosion Control Requirements for location

| Proportion by Weight | Grass Species | Min. % Germination | Min. % Pure Seed | Max. % Weed Seed |
|---|---|---|---|---|
| 10% | Japanese Clover (Lespedeza striata). | 85 | 85 | 0.50 |
| 20% | Chinese Lespedeza (Lespedeza cuneata). | 85 | 98 | 0.50 |
| 70% | Tall Fescue (Festuca arundinacea). | 85 | 85 | 0.50 |

3. Low-Maintenance Slope (Steeper than 3:1)-Refer to Erosion Control Requirements for location

| Proportion by Weight | Grass Species | Min. % Germination | Min. % Pure Seed | Max. % Weed Seed |
|---|---|---|---|---|
| 10% | Japanese Clover (Lespedeza striata). | 85 | 85 | 0.50 |
| 20% | Chinese Lespedeza (Lespedeza cuneata). | 85 | 98 | 0.50 |
| 70% | Tall Fescue (Festuca arundinacea). | 85 | 85 | 0.50 |

C. Turf Varieties shall be selected from the 2005 list of recommended Tall Fescue and Kentucky Bluegrass varieties, published by N. C. State University.

D. All seed shall bear an official "N. C. Certified Seed" label. Tags must be attached to each bag delivered on site.

2.7 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Pine Straw: Fresh, dry and free from debris, pine cones, or soil. Slash Pine is preferred.

C. Peat Mulch: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.

D. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 percent of dry weight.

E. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic; free of plant-growth or germination inhibitors; with maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

2.8 EROSION-CONTROL MATERIALS

A. Erosion-Control Fiber Mesh: Biodegradable twisted jute or spun-coir mesh, a minimum of 0.92 lb/sq. yd. (0.5 kg/sq. m), with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive lawns and grass for compliance with requirements and for conditions affecting performance of the Work. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Protect adjacent and adjoining areas from hydroseed overspray.

3.3 TOPSOIL PLACEMENT FOR LAWNS

A. Limit subgrade preparation to areas that will be planted in the immediate future.

B. Loosen subgrade to a minimum depth of 4 inches. Remove stones, sticks and roots larger than 2 inches in any dimension from subgrade, 1" in playing fields. Completely remove trash and other extraneous debris from subgrade.

C. Have topsoil tested by a certified soil testing laboratory to determine the type and quantity of soil amendments necessary.

D. Sift topsoil to remove stones and other objects larger than 1" in any dimension. Sift topsoil to remove stones and other objects larger than ½" in any dimension in all playing fields. Maximum object size for topsoil shall be achieved by sifting not by hand removal or raking following placement of topsoil.

E. Mix soil amendments and fertilizers with topsoil at rates required by soil testing. Delay mixing fertilizer if planting does not follow placing of planting soil within 4 days. Either mix soil before spreading or apply soil amendments on surface of spread topsoil and mix thoroughly into top 4 inches (100 mm) of topsoil before planting.

F. Mix lime with dry soil prior to mixing fertilizer.

G. Spread topsoil to a minimum depth of six inches (6").

3.4 SEEDING LAWNS

A. Sow seed with a spreader or a seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in 2 directions at right angles to each other.

B. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.

C. Sow seed at the following rates:

1. Seeding Rates:

a) General Lawn Areas- 200 lbs./acre.

b) Low-Maintenance Slope (3:1 or less)- 110 lbs./acre

c) Low-Maintenance Slope (Steeper than 3:1)- 140 lbs./acre

D. Rake seed lightly into top 1/4 inch of topsoil, roll lightly, and water with fine spray.

E. Hydroseed all slopes 3:1 or steeper.

F. Protect seeded areas 3:1 slope/grade or steeper against erosion by providing erosion-control blankets installed and stapled according to manufacturer's recommendations.

G. Protect seeded areas less than 3:1 slope/grade against erosion by spreading straw mulch after completion of seeding operations. Spread uniformly at a minimum rate of 2 tons per acre (45 kg per 100 sq. m) to form a continuous blanket 1-1/2 inches (38 mm) loose depth over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Anchor straw mulch by crimping into topsoil by suitable mechanical equipment.

## 3.5 MAINTENANCE OF NEW LAWNS

A. Begin maintenance of lawns immediately after each area is planted and continue until acceptable lawn is established. Maintain seeded lawns until Substantial Completion. Maintain all grassed areas as necessary to ensure a satisfactory lawn is achieved at Substantial Completion.

B. Maintain and establish lawns by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn.

1. Replant bare areas with same materials as for lawns.

2. Replace disturbed mulch.

C. Watering: Provide and maintain temporary hoses, and lawn-watering equipment to convey water from a water source to keep lawns uniformly moist to a depth of 4 inches.

1. Provide a source of water for irrigation. Utilize temporary irrigation meters, a well or water trucks as necessary for the water source.

2. Water seeded areas as necessary to promote vigorous growth of grass but at the minimum rate of 1 inch per week.

3. Water sodded areas per the requirements of the grower. Maintain moist soil to a depth of at least four inches.

D. Mow lawns as soon as there is enough top growth to cut with mower set at indicated height. Repeat mowing as required to maintain indicated height without cutting more than 40 percent of the grass height (minimum of 3 mowings). Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain following grass height:

1. Mow grass to a finished height of 2 to 3 inches high.

E. Apply pre-emergent herbicide to lawns areas. Apply 60 – 90 days after planting.

## 3.6 SATISFACTORY LAWN

A. Seeded lawns shall be considered satisfactory/acceptable provided requirements, including maintenance, have been met and a healthy, uniform, close stand of grass is established, free of weeds, bare spots exceeding 5 by 5 inches (125 by 125 mm), and surface irregularities.

B. Sodded lawns shall be considered satisfactory/acceptable provided requirements, including maintenance, have been met and a healthy, well-rooted, even-colored, viable lawn is established, free of weeds, open joints, bare areas exceeding 5 by 5 inches (125 by 125 mm), and surface irregularities.

C. Replant lawns that do not meet requirements and continue maintenance until lawns are satisfactory/acceptable.

D. Substantial Completion of the building and the remainder of the project may be achieved (pending prior Architect and Owner approval) before achieving a satisfactory/acceptable lawn. Continue to replant and maintain unsatisfactory/unacceptable lawn areas until acceptance is obtained. Warranties for lawns shall begin at the time of acceptance of the lawn.

3.7 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by lawn work from sidewalks and paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto surface of roads, walks, or other paved areas.

B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout maintenance period until lawn is established.

END OF SECTION 32 9200

# SECTION 32 9300 - EXTERIOR PLANTS

## PART 1 – GENERAL

### 1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

### 1.2 SUMMARY

A. This Section includes the following:

1. Trees
2. Shrubs
3. Groundcovers
4. Other Plant Materials
5. Stakes & Guys

### 1.3 SUBMITTALS

A. Installers Qualifications: Provide a list, with references, of the past three projects of similar scope.

B. Product Data: For each type of product indicated.

C. Plant Material Certifications:

1. Certificates of inspection as required by governmental authorities.
2. Label data substantiating that plant materials comply with specified requirements.

D. Planting Schedule:

1. Typewritten planting schedule.
2. Once accepted, revise dates only as approved in writing and submitted to Architect.

E. Maintenance Schedules: Typewritten instructions recommending procedures for maintenance of landscape work for one full year. Submit prior to completion of project.

### 1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer, who has successfully completed planting projects similar in size and complexity to this project. The installer's primary business (defined as a minimum of 60% of total billings) shall be exterior plant installation.

B. Installer's Field Supervision: Installer to maintain an experienced full-time supervisor on the project site when exterior planting is in progress.

C. Exterior Plant Materials:

1. Provide plant materials of quantity, size, genus, species, and variety indicated on the Drawings.
2. All plant materials and work shall comply with recommendations and requirements of ANSI Z60.1 “American Standard for Nursery Stock.”
3. Do not make substitutions. If specified landscape material is not obtainable, submit proof of non-availability to Architect, together with proposal for use of equivalent material.
4. The Architect may inspect plant materials either at place of growth or on site before planting, for compliance with requirements for genus, species, variety, size, and quality. Architect retains right to further inspect trees for size and condition of balls and root systems, insects, injuries and latent defects, and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees immediately from project site.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.5 DELIVERY, STORAGE AND HANDLING

A. Packaged Materials:
1. Deliver packaged materials in containers showing weight, analysis, and name of manufacturer or grower.
2. Protect materials from deterioration during delivery, and while stored at site.

B. Exterior Plant Materials
1. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery.
2. Deliver exterior plant materials after preparations for planting have been completed and plant immediately. If planting is delayed more than 6 hours after delivery, set plant materials in shade, protect from weather and mechanical damage, and keep roots moist and free from frost.
3. Do not remove container-grown stock from containers until planting time.
4. Balled and burlapped material shall be freshly dug.
5. Handle planting stock by root ball.

1.6 PROJECT CONDITIONS

A. Examine the subgrade, verify the elevations, and observe the conditions under which work is to be performed. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

B. Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate as required.

C. When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Architect before planting.

D. Provide all necessary safeguards for the protection of all planted areas until provisional inspection/acceptance is accomplished.

E. Planting Restrictions: Plant during one of the following periods.

1. Spring Planting: Unfrozen soil conditions March 1-June 1st.

2. Fall Planting: September 1-November 1st or until frozen soil conditions prevent work.

3. Summer Planting: June 1 – September 1 with approved irrigation system.

F. Coordination with Lawns: Install plant materials after finish grades are established and before planting lawns, unless otherwise acceptable to the Architect.

1. When planting exterior plants after lawns, protect lawn areas and promptly repair damage caused by planting operations.

## 1.7 WARRANTY

A. Warranty exterior plant materials for a period of one year after date of Final Completion against defects including death and unsatisfactory growth, except for defects resulting from neglect by Owner, abuse or damage by others, or unusual phenomena or incidents which are beyond Contractor's control.

1. The Contractor shall provide written notice to the Architect of any practice which will affect the warranty if not remedied promptly. The Architect will render an opinion of the conflict if necessary.

2. Make replacements of all dead plants or plants in impaired condition (more than 25% dead or dying) condition in early spring/fall following installation. Replacements of dead or rejected plants should again be made prior to the expiration of the warranty period.

## 1.8 MAINTENANCE

A. The Owner is responsible for maintaining all exterior plant material throughout the warranty period according to the submitted Maintenance Schedule.

B. Remove all stakes and guy wires at the end of the 12 month guarantee period.

# PART 2 – PRODUCTS

## 2.1 EXTERIOR PLANT MATERIALS

A. General: Provide nursery-grown plant materials complying with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

B. Label at least one tree and one shrub of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.

2.2 PLANTS

A. General: Provide healthy, disease-free plants of species and variety indicated. Provide only plants that are acclimated to outdoor conditions before delivery. Provide healthy, field-grown plants from a commercial nursery of species and variety shown or listed. Provide plants with heavy, well-branched tops and a vigorous well-developed root system.

2.3 FERTILIZER

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium. Revise fertilizer mix to remedy deficiencies found in soil.

1. Composition: 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium. Revise fertilizer mix to remedy deficiencies found in soil.

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.

2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

2.4 MULCHES

1. Organic Mulch: Six (6) month old well rotted double shredded native hardwood bark mulch not larger than 4” in length and 1/2” in width, free of woodchips and sawdust.

2. Pine Straw: Fresh, dry and free from debris, pine cones, or soil. Slash Pine is preferred. Coverage for 3" is one bale per 50sq ft.

2.5 WATER

1. Free of substances harmful to plant growth.

2.6 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 4 percent organic material content. Topsoil shall be fertile, friable, natural topsoil of loamy character, without admixture of subsoil material, obtained from a well-drained arable site, reasonably free from clay, lumps, coarse sands, stones, plants, roots, sticks and other foreign materials.

B. Topsoil Source:

1. Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

a) Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally well-drained sites where topsoil

occurs at least 4 inches (100 mm) deep; do not obtain from agricultural land**,** bogs or marshes.

2. Import topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from agricultural land**,** bogs or marshes.

3. Amend existing in-place surface soil to produce topsoil. Verify suitability of surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

   a) Surface soil may be supplemented with imported or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from agricultural land, bogs or marshes.

## 2.7 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:

   1. Class: Class T, with a minimum 99 percent passing through No. 8 (2.36-mm) sieve and a minimum 75 percent passing through No. 60 (0.25-mm) sieve.

   2. Class: Class O, with a minimum 95 percent passing through No. 8 (2.36-mm) sieve and a minimum 55 percent passing through No. 60 (0.25-mm) sieve.

   3. Provide lime in form of dolomitic limestone.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum 99 percent passing through No. 6 (3.35-mm) sieve and a maximum 10 percent passing through No. 40 (0.425-mm) sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.

G. Sand: Clean, washed, natural or manufactured, free of toxic materials.

H. Diatomaceous Earth: Calcined, diatomaceous earth, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

## 2.8 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 3/4-inch (19-mm) sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

   1. Organic Matter Content: 50 to 60 percent of dry weight.

   2. Feedstock: Agricultural, food, or industrial residuals; bio-solids; yard trimmings; or source-separated or compostable mixed solid waste.

B. Sphagnum peat moss: Sphagnum peat moss shall be partially decomposed, finely divided or granular texture, with a pH range of 3.4 to 4.8.

C. Peat: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.

D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.

1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with at least 0.15 lb (2.4 kg) of ammonium nitrate or 0.25 lb (4 kg) of ammonium sulfate per cubic foot (cubic meter) of loose sawdust or ground bark.

E. Manure: Well-rotted, unleached, poultry, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

## 2.9 MISCELLANEOUS PRODUCTS

A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

# PART 3 – EXECUTION

## 3.1 EXAMINATION

A. Examine areas to receive exterior plants for compliance with requirements and conditions affecting installation and performance. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Tree save areas as indicated shall be tagged and approved by the Architect prior to any clearing and/or thinning.

B. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing exterior plants from damage caused by planting operations.

C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

D. Lay out individual tree and shrub locations and areas for multiple exterior plantings. Stake locations, outline areas, adjust locations when requested, and obtain Landscape Architect's acceptance of layout before planting. Make minor adjustments as required.

E. Lay out exterior plants at locations indicated. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

F. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks, branches, stems, twigs, and foliage to protect during digging, handling, and transportation.

1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

3.3 PLANTING BED ESTABLISHMENT

A. Loosen subgrade of planting beds to a minimum depth of 4 inches (100 mm). Remove stones larger than 1 inch (25 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off of Owner's property.

1. Apply fertilizer directly to subgrade before loosening.

2. Spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.

a) Delay mixing fertilizer with planting soil if planting will not proceed within a few days.

b) Mix lime with dry soil before mixing fertilizer.

B. Finish Grading: Grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

C. Restore planting beds if eroded or otherwise disturbed after finish grading and before planting.

3.4 TREE AND SHRUB PLANTING

A. Set all plant materials plumb and in center of pit or trench as per detail.

1. Remove burlap and wire baskets from tops of root balls and partially from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.

2. Carefully remove root ball from container without damaging root ball or plant.

3. Backfill with an amended soil blend consisting of five (5) parts native soil, one (1) part organic amendment and one (1) lb. fertilizer.

4. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.

5. Spread roots without tangling or turning toward surface, and carefully work backfill around roots by hand. Puddle with water until backfill layers are completely saturated. Plumb before backfilling and maintain plumb while working backfill around roots and placing layers above roots. Tamp final layer of backfill. Remove injured roots by cutting cleanly, do not break.

6. Form a ring of soil around the edge of each planting pit to retain water.

B. Organic Mulching: Apply 3-inch (75-mm.) average thickness of organic mulch extending 12 inches (300 mm) beyond edge of planting pit or trench. Do not place mulch within 3 inches (75 mm) of trunks or stems.

3.5 TREE AND SHRUB PRUNING

A. Prune, thin, and shape trees and shrubs as indicated.

3.6 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants as indicated in details.

B. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

## 3.7 CLEANUP AND PROTECTION

A. During exterior planting, keep adjacent pavings and construction clean and work area in an orderly condition.

B. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged exterior planting.

## 3.8 DISPOSAL

A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 32 9300

SECTION 33 1000 – EXTERIOR WATER SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

B. State and Local Public Utilities (latest Edition, Addenda, and approved materials list).

C. Reference Specifications are referred to by abbreviation as follows:

| | | |
|---|---|---|
| 1. | American National Standards Institute | ANSI |
| 2. | National Sanitation Foundation | NSF |
| 3. | American Society for Testing and Materials | ASTM |
| 4. | American Water Works Association | AWWA |
| 5. | National Bureau of Standards | NBS |
| 6. | North Carolina Department of Transportation | NCDOT |
| 7. | North Carolina Department of Environmental Health | NCDEH |

1.2 SUMMARY

A. This section includes water service piping, fire protection service mains and appurtenances from the source of water to a point 5 feet outside the building.

B. Water Meter(s) will be furnished by the Local Utility Provider. Installation of water meter shall be part of the Work.

1.3 SUBMITTALS

A. Submit shop drawings and/or product data for the following:

1. Pipe
2. Fittings
3. Valves
4. Valve Boxes
5. Vault and Meter Box Enclosures and Accessories (including frames and covers, ladders, drains, sump pumps and wiring diagrams).
6. Fire Hydrants
7. Fire Department Connections
8. Backflow Preventers and Assemblies
9. Yard Hydrants
10. Thrust Restraint
11. Steel Encasement Pipe
12. Casing Spacers and End-seals
13. Detectable Marking Tape

14. Tracing Wire
15. Test Stations
16. Tapping Sleeve and Valves
17. Corporation Stop
18. Bedding Stone (NCDOT approved job-mix formula)
19. Water Service Assemblies for Water Meters

B. Certification provided by the contractor that all water systems and appurtenances have been tested and meet the provisions of the contract documents.

1.4 QUALITY ASSURANCE

A. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to water systems, and to the requirements of the latest edition of the North Carolina Erosion and Sediment Control, Planning and Design Manual for erosion control during installation.

B. Utility Compliance: Comply with the requirements of the Local Utility Provider Public Utilities' Standards (latest Edition, Addenda, and approved materials list).

C. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Prepare materials for shipping and transport as follows:

1. Ensure materials are dry and internally protected against rust and corrosion.
2. Protect materials against damage to threaded ends, flange faces, pipe belts and spigots, and coatings.
3. Set materials in best position for handling to prevent rattling.

B. Storage: Use the following precautions for materials during storage:

1. Do not remove end protectors unless necessary for inspection and reinstall for storage.
2. Protect materials from weather, moisture and dirt. If outdoor storage is necessary, elevate and support materials off the ground or pavement in watertight enclosures.
3. Store pipe in accordance with manufacturer's recommendations. Do not store plastic structures, pipe, and fittings in direct sunlight. Support materials to prevent sagging and bending.

C. Handling: Handle materials on-site to prevent damage.

1. Handle materials to prevent interior and exterior coating and pipe-end damage, and to prevent the entrance of dirt, debris, and moisture.
2. Handle pre-cast concrete manholes and other structures according to manufacturer's written rigging instructions.
3. If any portion of piping and fittings is damaged, repairs should be made in accordance with manufacturer's recommendations prior to installation.

1.6 PROJECT CONDITIONS.

A. Site Information: Perform site survey to verify existing utility locations as needed. Verify that water distribution system piping may be installed in compliance with the design and referenced standards.

B. Locate existing structures and piping to be closed and abandoned.

C. Existing Utilities: The location of existing utilities, including underground utilities, is indicated on the drawings insofar as their existence and location were known at the time of preparation of the drawings. However, nothing in these Contract Documents shall be construed as a guarantee that such utilities are in the location indicated or that they actually exist, or that other utilities are not within the area of operations. The Contractor shall make all necessary investigations to determine the existence and locations of such utilities far enough in advance of pipe laying to allow for adjustments due to conflicts in the horizontal and vertical positions of the pipeline.

1. Do not proceed with utility interruptions without receiving Architect's written permission.

2. Notify Architect not less than 48 hours in advance of proposed utility interruptions.

3. Do not interrupt existing utilities serving facilities occupied by others except when permitted by the utility owner and after arranging to provide acceptable temporary utility services.

4. Existing utilities across or along the line of work are indicated only in an approximate location. Locate all underground lines and structures. Call "NC one call" at 1-800-632-4949 prior to construction. If utilities are marked that are not shown on the plans, locate utility vertically and horizontally and provide information to architect. The contractor shall pay for any damage to and for maintenance and protection of existing utilities and structures.

D. Connections to Existing System:

1. Before the start of the construction, the Contractor shall dig test pits on all crossings of and connections to the existing system, as applicable, to determine the existing system location, size, and piping material. If the location, size, and piping material differs from that shown on the Drawings, notify Engineer immediately.

2. The Contractor shall make connections to the existing system under a pressure or non-pressure condition, as indicated, complying with the system owner's requirements for the time of day such work can be done. The Contractor shall pay all costs associated with the connections unless otherwise indicated. If the system owner performs the work, the Contractor shall arrange for the work to be done.

3. Valves are to be operated only by the Owner.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate with interior building water piping and interior building fire protection piping.

B. Coordinate with other utility work.

C. Utility interruptions shall be coordinated with local utility provider. Written notice 48 hours in advance of utility interruption shall be provided to all affected customers.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide pipe materials and fittings compatible with each other. All materials shall comply with the requirements of the Local Utility Provider Public Utilities' Standards (latest Edition, Addenda, and approved materials list).

2.2 PIPE

A. Polyvinylchloride (PVC)

1. Schedule 40 Pipe shall meet the requirements of ASTM D 1785, and is permissible for water service piping up to and include 3 inches in diameter. Use PVC solvent cement conforming to ASTM D 2564, and tested and certified for contact with potable water in accordance with ANSI/NSF Standard No. 61.

2. Polyvinylchloride (PVC) for diameters of 4 inches and greater shall meet the requirements of AWWA C900, Table 2 (Cast Iron OD) Class 150 except that all connections shall be made using elastomeric gasket joints. Cell classification for the pipe shall be 12454-B. The water pipe shall also have certifications from FM (Factory Mutual), UL (Underwriters Laboratory), and NSF (National Sanitation Foundation).

B. Ductile Iron (DI)

1. Ductile iron pipe shall meet the requirements of AWWA C600 and AWWA C605. 3" through 12" pipe shall be, at a minimum, pressure class 350, and 14" through 20" pipe shall be, at a minimum, pressure class 250. 24-inch diameter pipe shall be a minimum pressure class 200. Pipe shall have cement-mortar lining and a bituminous seal coat conforming to the requirement of AWWA Standard C104.

2. Buried pipe shall have either mechanical joint or push-on joint conforming to the requirements of AWWA C111. Bolts for mechanical joints shall be high strength cast iron having an ultimate tensile strength of 75,000 psi and a minimum yield point of 45,000 psi.

3. Flanged joints for ductile iron pipe shall meet requirements of ANSI B 16.1.

C. Copper Tubing

1. Copper tubing shall meet requirements of ASTM B88 for Type "L" copper, hard drawn, for above ground and Type "K' hard drawn for below ground.

2.3 FITTINGS

A. Polyvinylchloride (PVC)

1. General

a) Fittings for water pipe up to and include 2 ½ inches in diameter shall be Schedule 40 PVC.

b) All PVC Schedule 40 fittings shall be produced from PVC Type I cell classification 12454, conforming to ASTM D 1784. All injection molded PVC Schedule 40 fittings shall be certified for potable water service by NSF International and manufactured in strict compliance to ASTM D 2466.

c) Use PVC solvent cement conforming to ASTM D 2564, and tested and certified for contact with potable water in accordance with ANSI/NSF Standard No. 61.

B. Ductile Iron (D1)

1. General

a) Fittings for water pipe 3 inches in diameter and greater shall be ductile iron. Contractor shall use transition gaskets as necessary. Ductile iron fittings shall be in accordance with AWWA C600 or C605, latest edition. Pressure ratings shall be a minimum of 350 psi. All fittings shall be mechanical joint unless otherwise shown on the construction plans or approved by the Engineer.

b) All fittings shall have a cement mortar lining with asphaltic seal coat on the interior, and shall meet the requirements of the AWWA C104. Cement mortar lining shall be standard thickness.

c) Exterior, asphaltic coating for ductile iron fittings shall meet requirements of AWWA C600 as applicable.

2. Mechanical Joints

   a) Mechanical joints and jointing materials shall meet requirements of AWWA C111.

   b) MEGALUGS, or approved equivalent, shall meet requirements of ASNI/AWWA C600/A21.51.

3. Flanged Joints

   a) Flanged joints shall meet requirements of ANSI B16.1 and AWWA C115.

   b) Flange joint gasket shall be full-face or ring type made of rubber and meeting the requirements of ANSI B16.21 and AWWA C115.

C. Copper

1. Fitting for copper piping shall meet requirements of ASNI B16.22 for wrought copper, sweat joint. Soldered joints shall be made using ASTM B32 Alloy Grade Sn96 or Sb5 solder having a maximum lead content of 0.2%.

## 2.4 VALVES

A. Gate Valves

1. Sizes Smaller than 2 inches

   a) Gate valves smaller than 2 inches shall be bronze, solid wedge, rising stem, with at least 200 psi operating pressure.

2. Sizes 2 inches Through 12 inches

   a) All gate valves shall be resilient seat gate valves. Resilient seat gate valves 2 inches through 12 inches in size shall comply with AWWA C-509 or AWWA C515, latest revision, and be UL listed, FM Approved, as well as certified by NSF to Standard 61.

   b) All buried valves shall be manually operated non-rising stem, equipped with a 2-inch square AWWA operating nut, for installation in a vertical position, unless otherwise specified. All valves for underground vaults and above-ground service shall be manually operated outside stem and yoke (OS&Y).

   c) Valve ends shall be mechanical joint for buried underground service and flanged for underground vaults and above-ground service.

   d) The interior and exterior of the body and bonnet shall be coated with fusion bonded epoxy per ANSI/AWWA C550 Standard for Protective Interior Coatings for Valves and Hydrants.

   e) All internal parts shall be accessible without removing the body form the line.

   f) All valves shall open left (counter-clockwise).

   g) Valves shall be rated for 250 psi operating pressure and 500 psi test pressure.

   h) Valve stem extensions shall be required where the valve-operating nut is installed at a depth greater then four feet (4’).

B. Post Indicator Valves

1. Indicator post valves are of the same construction as other UL/FM gate valves except they are fitted with a 12-inch diameter bonnet flange onto which the Indicator Post bolts.

2. Indicator Posts are UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

## 2.5 VALVE BOXES

A. Valve boxes shall comply with AWWA M44 for cast-iron valve boxes. Materials shall include top section, adjustable extension (of length required for depth of burial of valve), cover (with lettering "WATER" cast or embossed on the cover), bottom section with base of size to fit over valve, and approximately 5-inch diameter barrel. All box assemblies shall have screw adjustment

B. Valve boxes shall be firmly supported, centered and plumb over the operating unit of the valve. Box cover shall be set flush with the surface of finished pavement or at such other level as may be directed by the Architect. Valve rod extension with guide shall be required to maintain a distance of 2' – 4' from operating nut to top of box. The extension shall be provided with a 2-inch square operating not on top and a coupling to connect the extension to the operating nut on the valve. All valves shall be properly restrained.

C. Extension pieces, if required, shall be cast iron or ductile iron. PVC pipe is not allowed for extensions.

## 2.6 VAULT AND METER BOX ENCLOSURES AND ACCESSORIES

A. This section includes enclosures for water meters 2 inches and smaller.

1. Meter box lids for all meter sizes shall be lightweight polymer concrete.
2. Precast Concrete Box (used with 1-1/2" or 2" water meters and assemblies):

a) Concrete box shall be manufactured by Stamie E. Lyttle Co., Inc. or approved equivalent.

## 2.7 FIRE HYDRANTS

A. Fire hydrants shall be UL and FM approved, and shall also comply with the AWWA Fire Hydrant Specification C-502 (latest revision) and the following:

1. Type: Compression - Dry Standpipe: Valve shall open against and close with the pressure. The design shall be such that all internal operating parts can be removed through the standpipe and main valve rod extended without excavating.
2. Size: Internal valve diameter shall be a minimum 4-1/2".
3. Inlet Size and Type: 6" mechanical joint end with accessories.
4. Hose Nozzles: Each hydrant shall be equipped with two 2-1/2" I.D. hose nozzles matching local fire department hose threads (National Standard Threads) one quarter turn bayonet lock or threaded in with O-ring seal and suitable locking arrangement.
5. Steamer Nozzle: Each hydrant shall be equipped with one 4-1/2" Steamer Nozzle matching local fire department hose threads (National Standard Threads) one quarter turn bayonet lock, or threaded in with O-ring seal and suitable locking arrangement.
6. Direction of Open: Left, counterclockwise.
7. Size and Shape of Operating Nut and Cap Nuts: Nut and Cap Nuts shall be 1-1/2" point to flat pentagon. Each hydrant shall be equipped with a weather cap.
8. Seal Plate: The hydrant shall be constructed with a moisture-proof lubricant chamber that encloses the operating threads, thereby automatically lubricating the threads each time the hydrant is operated. The lubricant chamber shall be enclosed with at least three O-rings. The two lower O-rings will serve as pressure seals. The third O-ring will serve as a combined dirt and moisture seal to prevent foreign matter from entering the lubricant chamber. The hydrant shall be equipped with either an anti-friction washer or bronze bushing to reduce operating torque. The bonnet will be secured to the hydrant using bolts and nuts.
9. Standpipe - Groundline Safety Construction: The standpipe sections shall be connected at the groundline by a two part, bolted safety flange or breakable lugs. The main valve rod sections shall be connected at the groundline by a frangible coupling. The standpipe and groundline safety construction shall be such that the hydrant nozzles can be rotated to any desired position without disassembling and

removing the top operating components and the top section of the standpipe. The minimum inside diameter of the standpipe shall be 6".

10. Main Valve, Rod Assembly: The main valve rod assembly shall be constructed to allow removal of all operating parts through the standpipe regardless of depth of bury, using a removal wrench which does not extend below the groundline of the hydrant. The main valve seat ring shall be bronze, and its assembly into the hydrant shall involve bronze to bronze thread engagement, and the valve assembly pressure seals shall be obtained without the employment of torque compressed gaskets. The design of the main valve rod shall be such that operating threads at the top of the rod and the valve assembly threads at the bottom of the rod are isolated from contact with water in the standpipe or in the hydrant inlet shoe.
11. Drain Valve: The operation of the drain mechanism shall be correlated with the operation of the main valve and shall involve a momentary flushing of the drain ports each time the hydrant is opened. The drain ports shall be fully closed when the hydrant valve is more than 2-1/2 turns open and the drainage channel in the bronze valve seat ring shall connect to two or more outlet drain ports. No springs may be employed in the hydrant valve or drain valve mechanism.
12. Depth of Bury: Normally hydrants shall be suitable for installation in trenches 4-1/2' deep. Fire hydrants shall be adjusted to accommodate depths of bury greater than 4 ½' deep and to meet actual field conditions. Adjustments shall be made per manufacturer's recommendations.
13. Painting Instruction: Two prime coats and one aluminum finish coat shall be used, unless otherwise specified. Exposed area of fire hydrant shall receive one field coat of aluminum after installation. The wetted surface of the hydrant shoe shall be epoxy coated to prevent corrosion of the waterway.
14. Pressure Rating: Test pressure 400 psi, working pressure 200 psi.

B. Approved Manufacturers include:
   1. Mueller Centurion A-421
   2. Kennedy 4-1/4" Figure K-81A
   3. U.S. Pipe - Metropolitan 250
   4. American Flow Control - Mark 73

## 2.8 BACKFLOW PREVENTERS AND ASSEMBLIES

A. Reduced Pressure Zone (RPZ)
   1. Diameters ¾" through 2"
      a) Mainline valve body and caps including relief valve body and cover shall be bronze. Check valve moving member shall be center stem guided. All hydraulic sensing passages shall be internally located within the mainline and relief valve bodies and relief valve cover. Diaphragm to seat area ratio shall be 10:1 minimum. Relief valve shall have removable seat ring. Check valve and relief valve components shall be constructed so they may be serviced without removing the valve body from the line. All seat discs shall be reversible. Shut-off valves and test cocks shall be full ported ball valves.
      b) The assembly shall be rated to 175 psi water working pressure and water temperature range from 32°F to 140°F.
      c) The assembly shall meet the requirements of ASSE Standard 1010; AWWA Standard Code C506-78; and approved by the Foundation for Cross Connection Control and Hydraulic Hydraulic Research at eh University of Southern California.
   2. Diameters 2 ½" through 10"
      a) Main valve body shall be Ductile iron ASTM A536, Grade 65-45-12.

b) Coating shall be Fusion epoxy coated internal and external AWWA C550-90.

c) Shut-off valves shall be NRS and OS & Y resilient wedge AWWA C509 gate valves.

d) Trim shall be Bronze ASTM B584 Alloy C83600.

e) Elastomer discs shall be EPDM.

f) Sprint shall be stainless steel.

g) The valve body shall be constructed to allow for the removal and servicing of all parts without removing the valve body from the waterline.

h) The assembly shall be rated to 175 psi water working pressure and water temperature range from 32°F to 140°F.

i) The assembly shall meet the requirements of ASSE Standard 1010; AWWA Standard Code C506-78; and approved by the Foundation for Cross Connection Control and Hydraulic Research at the University of Southern California.

j) The assembly shall be tested in accordance with the manufacturer's recommendation or the local cross-connection control program, whichever is more stringent.

## 2.9 THRUST RESTRAINT

A. Proved thrust restrain consisting of concrete blocking, bell restraint harness, retainer gland type or restrained joint type pipe at all changes in direction of pressure pipelines and as shown on construction drawings.

B. Concrete thrust blocking units shall be as shown on the construction drawings or as directed by the inspector based upon field conditions. Concrete thrust blocking shall bear against undisturbed earth, and concrete shall have 3,000 psi strength at 28 days, and shall meet requirements of ASTM C94.

C. Where Lug Type retainer glands are used, installation must conform to the recommendations of the manufacturer before the pipe is backfilled and tested.

## 2.10 STEEL ENCASEMENT PIPE

A. Steel pipe shall be welded or seamless, smooth wall consisting of Grade "B" steel as specified in ASTM A-139. Spiral welded steel pipe is not permissible.

B. Minimum yield strength shall be 35000 psi, and pipe thickness shall be a specified on the construction plans.

C. All pipe shall be furnished with beveled ends prepared for field welding of circumferential joints. All burrs at pipe ends shall be removed.

D. Encasement pipe must be approved by the appropriate controlling agency (NCDOT, etc.) and the Architect prior to ordering.

## 2.11 CASING SPACERS AND END-SEALS

A. Casing Spacers:

1. Casing Spacers shall be one of the following:

a) Cascade

b) Advance Products & Systems, Inc. Model SI

c) Pipeline Seal and Insulator, Inc. Model No. C8G-2, Model No. C12G-2

2. Casing spacers shall be centered and restrained unless otherwise shown on the drawings.

B. End-Seals:

1. End-Seals shall be one of the following:

a) Advance Products & Systems, Inc. Model AC

b) Pipeline Seal and Insulator, Inc. Model C

2.12 DETECTABLE MARKING TAPE

A. Detectable marking tape shall be installed above all waterline pipe (including all service laterals).

B. Plastic marking tape shall consist of one layer of aluminum foil laminated between two layers of inert plastic film. Tape shall be resistant to alkalis, acids and other destructive agents commonly found in the soil. The laminate shall be strong enough that the layers cannot be separated by hand.

C. Tape shall be a minimum of 4-1/2 mils thick with a minimum tensile strength of 60 lbs. in the machine direction and 58 lbs. in the transverse direction per 3" wide strip. Tape color shall be APWA Color Coded for marking the particular utility line and shall be imprinted with a continuous warning message to indicate the type of utility being marked, the message normally being repeated every 16” to 36". Tape shall be inductively locatable and conductively traceable using a standard pipe and cable-locating device. Tape shall be 3" wide Terra Tape "Sentry Line Detectable 620," or approved equivalent.

2.13 TRACING WIRE

A. Tracing Wire shall be installed on all non-metallic waterline (including all service laterals).

B. Wire shall be No. 12, stranded, type THHN, thermoplastic insulated and nylon jacketed. Wire shall be color coded blue for water.

C. Acceptable Wire Connectors:

1. Set screw pressure type for use with No. 12 stranded wire size. Holub Industries MA-2, Ideal Industries Model 30-222, or approved equal.

2. C-Tap for two way splicing of tracer wire, for use with No. 12 stranded wire size. T&B #54705 or approved equal.

3. Split bolts, three wire type for splicing of tracer wire, for use with No. 12 stranded wire size ILSCO Catalog #SEL-2S or approved equal.

D. Electric Tape – Vinyl electric tape.

E. Electrical Coating - Scotchkote 3M electrical coating Part No. 054007 or approved equal. .

F. Wire nut – non-conductive for No. 12 stranded wire size.

2.14 TAPPING SLEEVE AND VALVES

A. Tapping Sleeves

1. Fabricated Steel

a) The body of the tapping sleeve shall be of 3/8” carbon steel, ASTM grade A285.

b) Flange to be AWWA C207 Class D ANSI, 150 lb. drilling.

c) The carbon steel body shall have a 12 mil thick coating of fusion-bonded epoxy. Bolts shall be 18-8, Type 304 stainless steel.

d) Gaskets shall be Grade 60 compounded for use with water, alkalies, mild acids and most hydro-carbon fluids, up to 212°F.

1. Stainless Steel

a) The body of the tapping sleeve shall be of 18-8 type 304 stainless steel.

b) Branch/flange to the ductile iron, carbon steel or 304 stainless steel, 150 lb. drilling.

c) MJ Gland shall be permanently affixed to the outlet branch and be 304 stainless steel.

d) Gaskets shall be Grade 60 compounded for use with water, alkalies, mild acids and most hydro-carbon fluids, up to 212° F.

e) Clamping hardware (nuts, bolts and washers) shall be 18-8 type 304 stainless steel, with plastic anti-gall washers. Drop-in bolts or welded-on studs are acceptable.

2. Fabricated Steel with Mechanical Joint Ends

a) Sleeve body, valve flange, gaskets, hardware and coating to be the same as the fabricated steel tapping sleeve.

b) The mechanical joint glands to be ASTMA-36 iron or ductile iron.

c) The gland retaining hardware (nuts, bolts and washers) to be 18-8 type 304 stainless steel.

3. Case Iron with Mechanical Joint Ends

a) The body and glands of the tapping sleeve shall be of ASTM-126, Class B cast or ductile iron. Sleeve shall be furnished complete with all mechanical joint accessories (bolts, nuts, gaskets and glands), and shall have a bituminous seal coating.

b) Valve flange, body gaskets and clamping hardware (bolts, nuts and washers) shall be as specified for the fabricated steel tapping sleeve.

4. Tapping Sleeve Applications

a) The stainless steel, fabricated steel (with mechanical joint ends), or cast/ductile iron (with mechanical joint ends) tapping sleeves may be used for any approved tap on C-900 PVC or ductile iron water main.

b) The stainless steel, fabricated steel (with mechanical joint ends), or cast/ductile iron (with mechanical joint ends) tapping sleeves may be used for all approved taps on asbestos-cement pipe (except 16” size) and for size-one size or one size down taps on all other pipe material.

c) Due to the non-availability of the mechanical joint tapping sleeve for 16” asbestos-cement pipe, the stainless steel sleeve must be used for taps on this pipe.

d) The fabricated steel tapping sleeve may be used for approved two (or more) size down taps on C-900 PVC, cast iron or ductile iron water main.

e) Application Chart

| Taps | Size on Size | Cast Iron, Asbestos Cement, Transite | PVC | Ductile Iron |
|---|---|---|---|---|
| Type | Stainless Steel | ***Stainless Steel | Stainless Steel | Stainless Steel |
| of | Mechanical Joint | * Mechanical Joint | Mechanical Joint | Mechanical Joint |
| Sleeve | | | **Fabricated Steel | **Fabricated Steel |

* Except on 16” A/C pipe

** Approved for use on 2 or more downsize taps only.

***Mueller H300 can not be used on A/C and C.I. pipe.

5. Certification, Testing and Installation

   a) The following testing and conditions relating to tapping sleeves apply to all manufacturers.

      i. The tapping sleeve shall be tested in place to a minimum of 200 psi.

      ii. If the sleeve fails to the 200 psi pressure test, the original failed sleeve shall be replaced with an entirely new sleeve.

      iii. The concrete thrust block shall be poured to also support the tapping sleeve from beneath. The tapping sleeve, valve and tapping machine assembly is to be adequately supported during the tapping operation to prevent movement or rotation of the tapping sleeve.

      iv. Installation instruction must be followed in strict accordance with the manufacturer's recommendations.

B. Resilient Seated Tapping Valves

   1. Tapping valves for diameters 2" through 12" shall meet the specifications as referenced in Section 2.4.A.2 except, the body seat rings shall have a clear inside opening sufficient to pass a cutter of full diameter and equal to the nominal size of the valve. The outlet end shall be suitable for use with the type of pipe specified.

   2. Tapping valves will be suitable for use with all approved manufactured tapping sleeves without modification.

C. Tapping-Sleeve Assemblies shall comply with MSS SP-60. Include sleeve and valve compatible with drilling machine.

## 2.15 CORPORATION STOP

A. The corporation stop will have tapered inlet threads in accordance with AWWA C800, latest edition. The corporation stop shall be made of a bronze alloy. It shall be similar to the Mueller compression connection type of or the Ford pack joint type.

## 2.16 WATER SERVICE ASSEMBLIES FOR WATER METERS

A. Water Meters will be furnished and installed by the local utility department.

B.

C. Water Service Setter for 1 ½" and 2" Water Meters

   1. All materials for the installation of water services shall be as follows or approved equal:

      a) General: All 1 ½" and 2" meter setters shall be constructed of seamless threaded red brass pipe, standard Type K hard copper tube (per ASTM B-88-62,) high quality brass (per AWWA C-800,) and leadless solder, and provide horizontal female pipe threads on both front and rear connections. Setters must include a valved bypass for meter maintenance, except for irrigation and residential meters.

      b) Bypass: Meter setters shall have an appropriately sized bypass line with an inverted key or ball-type stop threaded directly into the inlet bypass tee fitting. This bypass valve shall have a solid tee head and be either lock wing type or provide a bracket or other device to lock this valve in the "off" position upon installation. If copper tube is used for the bypass line, the compression connection for the copper side of the bypass valve must be as produced by the following manufacturers:

Mueller Co., “110 compression connection for copper pipe; or

Ford Meter ox co, “Pack Joint” connection for copper pipe; or

A.Y. McDonald, “T” compression connection for copper pipe.

Otherwise, a tee head inverted plug or ball type bypass valve is required with a threaded connection. Both of the bypass tee fittings, (inlet and outlet) shall have brace pipe eyelets cast within them to stabilize setter upon installation.

c) Angle Valves: Flanged, inverted key or ball-type “tee head” angle valves are required on both meter connections, and will include lock wings and meter support bracket to aid in meter installation. Pack joint or compression connections are NOT allowed on the vertical riser pipe; these connections must be threaded or soldered copper. Valves shall be double drilled, (2” size only,) to accommodate both 1 1/2” and 2” meters. Angle or ball valves shall provide a stop or check to limit movement of tee head 90° Maximum, (from fully open to completely off). Arrows cast within the inlet valve shall indicate direction of flow while in service.

d) Dimensions: Meter setters shall accommodate the following meter dimensions:

1 ½ “ flanged meter laying length: 13”, plus gaskets

2” flanged meter laying length: 17”, plus gaskets

The rise or height of meter setter, measured vertically from center line of inlet pipe thread to center line of meter flange bolt shall be:

1 ½” meter setter, maximum height of 8 ½”

2” meter setter, maximum height of 9 ½”

The copper used on the bypass and vertical riser pipe, (if so equipped) shall be Type K and comply with ASTM B-88-62, which states outside diameters as shown here:

¾” nominal pipe size, .875” outside diameter, .065” wall

1” nominal pipe size, 1.13” outside diameter, .065” wall

1 ½” nominal size pipe, 1.63” outside diameter, .072” wall

2” nominal size pipe, 2.13” outside diameter, .083” wall

The bypass assembly shall be sized as follows:

1 ½” meter setter requires minimum 1” bypass pipe & valve

2” meter setter requires minimum 1” bypass pipe & valve

e) Backflow prevention devices at yokes are not to be used.

PART 3 – EXECUTION

3.1 INSTALLATION OF NEW WATER SYSTEMS

A. Excavating and Backfilling

1. Contractor shall do all excavating of any and all materials encountered in the course of excavating for all underground utility systems. After the pipe is in place, backfill with suitable earth, free from rocks, organic material, etc.

   a) Provide all necessary shoring required for the protection of excavations, existing utilities and workmen and do all necessary pumping required to keep excavation and pipe free of water from any source at all times.

   b) Provide sufficient barricades, etc., adjacent to excavations to safeguard against injury to workmen and the public. Provide and maintain sufficient warning lanterns at walks, roadways, and parking areas to provide safety at all times.

   c) Where roots of live trees are encountered in excavations, they shall be carefully protected during construction.

   d) Exercise special care in backfilling trenches to guard against disturbing the joint.

   e) Remove and dispose of any material not used for backfill.

2. Removal of subsurface obstructions which are uncovered during excavation for installation of the water systems shall be removed by the Contractor at his expense. This shall include removal of existing concrete or brick of existing building foundations, footings, abandoned utility piping, wires, structures, rock boulders, etc., which may not be visible from surface investigations before construction, but will interfere with new installations. If such obstructions are encountered, they shall be removed two feet from around the area of new facility and backfilled with a suitable material as specified.

B. Pipe Installation

1. Trenching, pipe laying, and backfilling shall be accomplished in a manner to prevent damage and mis-alignment of the pipe. Ductile Iron water main (DIP) and Polyvinyl Chloride (PVC) water main shall be installed in accordance with the latest version of AWWA C600 and C605, respectively. Water mains shall be buried to a depth below the frostline or to a depth sufficient to provide a minimum of 30 inches cover, whichever is greater.

2. Take precautions to ensure that pipe and related items are not damaged in unloading, handling and placing in trench. Examine each piece of material just prior to installation to determine that no damage has occurred. Remove any damaged material from the site and replace with undamaged materials.

3. Keep pipe clean. Exercise care to keep foreign material and dirt from entering pipe during storage, handling and placing in trench. Plug or cap line at the end of each day.

4. Do not lay pipe when weather or trench conditions are unsuitable.

5. Line and grade hubs shall be set by a registered surveyor at intervals to accurately insure proper location of water line and appurtenances. This shall include finished grade centerline stakes for fire hydrants, stakes at all fittings, referencing all property pins, etc. Cut sheets are required where the water line is to be laid to a grade according to the profiles in the plans, or where the future road grade is not yet to within 6” of its final location.

6. Water Pipe Laying

a) Laying of water pipe shall be accomplished only after the trench has been dewatered and the foundation and/or bedding has been prepared. Mud, silt, gravel, and other foreign material shall be kept out of the pipe and off the jointing surfaces.

b) All pipe laid shall be retained in position so as to maintain alignment and joint closure until sufficient backfill has been completed to adequately hold the pipe in place. All pipe shall be laid to conform to the prescribed line and grade shown on the plans and shall include digging out for bell ends.

c) Water pipe runs intended to be laid straight shall be so laid. Deflection from a straight line may be made by deflecting the joints only when permission has been given by the Architect or Inspector. Joint deflection in pipe shall not exceed one-half that recommended by AWWA Standards or the manufacturer, whichever is less. Changes in grade or alignment which cannot be made by deflecting pipe joints shall be made by use of proper bends, offsets or special fittings as required.

d) The water pipe, unless otherwise approved by the Architect or Inspector, shall be laid upgrade from point of connection of the existing water line or form a designated starting point. Water pipe shall be installed with the bell end forward or upgrade. When pipe laying is not in progress, the forward end of the pipe shall be kept tightly closed with a water tight plug or cap. Plywood or plastic is not acceptable as a plug or cap.

e) The pipe shall be fitted and matched so that when laid in the work, units will form a smooth, uniform invert.

f) Prior to joining the pipe, all surfaces of the pipe to be joined and the surfaces of factory made jointing materials shall be clean and dry. Lubricants, primers, adhesives, etc., shall be applied and the pipes joined as recommended by the manufacturer's specifications. Sufficient pressure shall be applied in making the joint to assure that the pipe is "home". The interior of the pipe shall be cleaned all foreign material as the work progresses. At the end of the work day, the last pipe laid shall be blocked to prevent creep, and closed with a water tight plug or cap.

g) Joining pipe

i. Ductile iron pipe to be joined as follows:

1) Mechanical joint pipe

(a) Thoroughly clean inside of the bell and 8" of the outside of the spigot end of the joining pipe to remove oil, grit, excess coating and other foreign matter from the joint. Paint the bell and spigot with soap solution (half cup granulated soap dissolved in 1 gallon water). Slip cast-iron gland on spigot end with lip extension of gland toward end of pipe. Paint rubber gasket with or dip into the soap solution and place on the spigot end with thick edge toward the gland. (Note: When installing PVC pipe into M.J. fittings, the beveled end of the pipe must be cut off).

(b) Push the spigot end forward to seat in the bell. Then carefully press the gasket into the bell so that it is located evenly around the joint. The gland is moved into position, bolts inserted and nuts turned finger tight. Tighten all nuts to torque listed below:

| Bolt Size (inches) | Torque (ft – lbs) |
|---|---|
| 5/8 | 40-60 |
| 3/4 | 60-90 |
| 1 | 70-100 |
| 1 – 1/4 | 90-120 |

(c) Tighten nuts on alternate sides of the gland until pressure on the gland is equally distributed, and torque value is reached.

(d) Permissible deflection in mechanical joint pipe shall not be greater than one-half of that listed in AWWA C600.

2) Push-on joint ductile iron pipe

(a) Thoroughly clean inside of the bell and 8" of the outside of the spigot end of the joining pipe to remove oil, grit, excess coating, and other foreign matter. Flex rubber gasket and insert in the gasket recess of the bell socket. Apply a thin film of gasket lubricant supplied by pipe manufacturer, to the gasket and spigot end of the joining pipe.

(b) Insert spigot end of pipe into socket with care. The joint shall then be completed by forcing the plain end to the bottom of the socket with a forked tool or jack type device. Field cut pipe shall have the end filed to match the manufactured spigot end.

(c) Permissible deflection in push-on joint pipe shall not be greater than one-half of that listed in AWWA C600.

ii. Polyvinyl chloride (PVC) pipe shall be joined in accordance with manufacturer's recommendations.

Polyvinyl Chloride (PVC) Push-on Joint Pipe

1) Thoroughly clean inside of the bell and 1" beyond the reference mark on the spigot end of the joining pipe. Make certain the bell and rubber gasket have no foreign material that could interfere with the proper assembly of the pipe spigot.

2) Lubricate the gasket and spigot end of the pipe, using lubricant supplied by pipe manufacturer.

3) Insert the spigot end into the bell. Align the pipe sections and push the spigot end in until the reference mark on the spigot end is flush with the end of the bell. Use a bar and block of wood to push pipe home.

4) Field cut pipe shall be square cut and beveled to ensure proper assembly. Use a factory finished beveled end as a guide to produce an equivalent angle and length of taper.

h) Tracing wire shall be accessible for test hook-up at all water meter boxes and test stations. The tracing wire must be continuous and completely insulated from ground. The tracing wire will be attached to the top of the pipe using duct tape at an interval no great than 16 feet. Tracing wire within test stations and meter boxes shall be stripped ¾" from the end and capped with a wire nut to minimize electrical ground contact. Test stations shall be installed within 2 feet of all fire hydrants and at intervals no greater than 1,000 feet. All connections at the main line must be electrically sound and physically secure with screw connections or clamps. All connections must be taped with electrical tape and sealed with an electrical coating sealant. Tracing wire for waterline shall be color coded blue.

i) Place underground warning tape directly above all water mains 18" below finished grade.

C. Relation of Water Mains to Sewers

1. Lateral Separation of Sewers and Water Mains. Water mains shall be laid at least 10 feet laterally from existing or proposed sewers, unless local conditions or barriers prevent a 10-foot lateral separation in which case:

a) The water main is laid in a separate trench, with the elevation of the bottom of the water main at least 18 inches above the top of the sewer; or

b) The water main is laid in the same trench as the sewer with the water main located at one side on a bench of undisturbed earth, and with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.

2. Crossing a Water Main Over a Sewer. Whenever it is necessary for a water main to cross over a sewer, the water main shall be laid at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer, unless local conditions or barriers prevent an 18 inch vertical separation in which case both the water main and sewer shall be constructed of ferrous materials and with joints that are equivalent to water main standards for a distance of 10 feet on each side of the point of crossing.

3. Crossing a Water Main Under a Sewer. Whenever it is necessary for a water main to cross under a sewer, both the water main and the sewer shall be constructed of ferrous materials and with joints equivalent to water main standards for a distance of 10 feet on each side of the point of crossing. A section of water main pipe shall be centered at the point of crossing.

D. Installation of Valves, Fittings, and Hydrants

1. General: Valves, fittings and hydrants shall be set and joined to the piping system as specified for cleaning, laying and joining pipe.

2. Valves and Valve Boxes: Cast iron valve boxes shall be firmly supported, centered and plumb over the operating unit of valve. Box cover shall be set flush with the surface of finished pavement or at such other level as may be directed by the Architect or Inspector. Valve rod extension with guide shall be required to maintain a maximum distance of 2'-4' from operating nut to top of box. All valves shall be properly restrained.

3. Cross Connections: Drainage branches or blow-offs shall not be connected to any sewer, submerged in any stream or installed in any manner which, in the opinion of the Architect or Inspector, will constitute a contamination or cross-connection hazard.

4. Hydrants

a) Connection to Main: Each hydrant shall be blocked and/or restrained and connected to the main as shown in the standard details. Each hydrant shall be provided with a minimum 6" diameter branch, controlled by an independent 6" resilient seat gate valve.

b) Setting of Hydrants: When hydrants are set, a drainage pit two feet in diameter and two feet below the bowl of the hydrant shall be excavated. The pit shall be filled with coarse gravel or #57 clean stone, mixed with coarse sand, to a level of 6" above the weephole. No hydrants drainage pit shall be well braced against unexcavated earth with suitable concrete blocking, and when directed shall be restrained to the pipe with approved harnessing.

c) All hydrant valves shall be restrained with a hydrant tee.

d) All hydrants shall be thoroughly cleaned of dirt or foreign matter before setting.

5. Anchorage of Fittings: All fittings (i.e., each bend, tee, plug, valve and cap) shall be prevented from moving by means to adequate thrust reaction blocking and/or mechanical retrains, as shown in the standard details.

E. Installation of Fabricated Steel Tapping Sleeves

1. Clean pipe surface thoroughly, particular in the area where the gasket will seal. The Contractor shall wipe the pipe in the area where the tap is to be make with 1% chlorine solution prior to installing the sleeve.

2. Lubricate pipe and gasket with soap and water or gasket lubricating solution. Do not use grease or pipe lubricant. Under no condition shall antifreeze be used.

3. Mount body halves on pipe and ensure gasket is secure in gasket grove, and the tapping nipple is pointing in it final direction so it will not be moved or rotated on the pipe.

4. Insert bolts and hand tighten nuts, keeping equal gaps between body halves.

5. Prior to tightening nuts, position outlet as required to suite the installation. Ensure that test connection is accessible.

6. Tighten bolts, alternating from one side to the other to equalize the gap between halves. Continue to tighten bolts until sleeve halves conform to the contour of the pipe and all bolts are to a uniform tightness. The required torque for dry threads will be 70-100 ft. lbs. (Lubricated threads 35-50 ft. lbs). On thin wall or badly corroded pipe, care should be taken to prevent crushing or collapsing of the pipe.

7. A pressure test is required prior to tapping to test the sleeve and valve in place.

   Prior to pressure testing, the Inspector shall obtain a reading of line pressure in the system, either from a hydrant or a service. The pressure test should be at 2 ½ times line pressure or 200 psi, whichever is greater. The duration of this pressure test shall be a minimum of ten minutes. If the sleeve fails the pressure test it shall be completely removed and returned and a new sleeve used. The tapping sleeve, valve and tapping machine assembly is to be adequately supported during the tapping operation to prevent movement or rotation of the tapping sleeve.

8. Proceed with tapping operation.

   Complete tapping procedure and perform the necessary checking as required, and furnish the Inspector with the tap coupon.

9. Check the bolts for tightness and re-torque, if required.

F. Installation of Services

1. ¾”, 1”, 1 ½ “ and 2” Services

   a) All taps shall be made with service saddles.

   b) Taps shall be made on a 45° angle.

   c) Corporation stops shall be “cc” thread inlet and copper flare outlet for the copper service.

   d) Tap shall be made with a tapping machine equipped with a bit designed for the type of pipe being tapped.

   e) Distance between taps or from a joint or bell shall be a minimum of 18”.

   f) Service pipe shall be type “K” soft copper.

   g) Services shall be installed with 42” minimum cover up to meter yoke where yoke shall be installed so that meter will set 12”-18” below finished grade.

   h) Meter yokes shall be installed with a tail piece of type “K” soft copper 36” long.

i) Meter yoke and box shall be set as shown on the construction drawings, or as directed by the Architect or Inspector. Meters shall be installed on reasonably level ground or conform to the angle of the slope.

j) Backfill shall be hand tamped up to service pipe at tap to prevent corporation stop from being broken off during backfilling.

k) Traffic box to be of cast iron in driveways.

3.2 AS BUILT SURVEY

A. Provide the owner an as built survey of all visible surface structures and appurtenances to include hydrants, valves, vaults, etc. for NCDENR certification. Also provide an as built survey of storm sewer and utilities crossing the waterline to verify depth of clearances to the waterline.

PART 4 – TESTING

4.1 TESTING TECHNIQUES FOR WATER DISTRIBUTION SYSTEM

B. Each properly isolated section of the piping system, including all water services, shall be subjected to a pressure test of 150 psi, or 1 ½ times the working pressure whichever is greater, measured at the high point of the system. New water mains shall be tested for leakage and any necessary repairs and re-testing shall be accomplished as specified in AWWA standards. Per AWWA C605/C600, leakage formula is based on a testing allowance of 10.5 gallons per day per mile per inch of pipe. Maintain this pressure for a minimum of two hours with an allowable leakage as follows:

| WATER LINE TEST BASED ON 150 PSI | | WATER LINE TEST BASED ON 150 PSI | |
|---|---|---|---|
| SIZE | MAX. ALLOWABLE LEAKAGE | SIZE | MAX. ALLOWABLE LEAKAGE |
| 3/4" | .0138 (GAL/2 HRS)/100 L.F. | 6” | .1103 (GAL/2 HRS)/100 L.F. |
| 1” | .0184 (GAL/2 HRS)/100 L.F. | 8” | .1471 (GAL/2 HRS)/100 L.F. |
| 1 ½” | .0276 (GAL/2 HRS)/100 L.F. | 12” | .2207 (GAL/2 HRS)/100 L.F. |
| 2” | .0368 (GAL/2 HRS)/100 L.F. | 16” | .2942 (GAL/2 HRS)/100 L.F. |
| 3” | .0552 (GAL/2 HRS)/100 L.F. | 20” | .3678 (GAL/2 HRS)/100 L.F. |
| 4” | .0736 (GAL/2 HRS)/100 L.F. | 24” | .4413 (GAL/2 HRS)/100 L.F. |

Prior to applying pressure to the lines, all reaction blocking, and/or mechanical restraints shall have been completed to the satisfaction of the Architect or Inspector. As the pipes are being filled, all air shall be expelled from the pipes by providing manual air relief valves at the high points of the system.

C. Any defects discovered during this test shall be repaired and the test repeated until the results are satisfactory to the Architect or Inspector. Provide all equipment, materials and labor necessary to conduct the test. Provide a suitable test pump and properly calibrated gauge or other means for measuring leakage (such as a clean 50-gallong barrel with top cut out) which is satisfactory to the Architect or Inspector.

D. Water used for flushing, sterilization and testing shall be furnished by the Contractor at his expense. Filling of water line may be performed after permission has been obtained from authority responsible for coordinating this activity. Contractor is not permitted to operate valves on existing lines.

4.2 DISINFECTION

A. Prior to being placed in service, the pipe line and appurtenances shall be disinfected in general accordance with ANSI/AWWA C651, latest edition, "AWWA Standard for **Disinfecting Water Mains**". Supplemental procedures stipulated in the following sections compliment the AWWA C651 Standard, particularly with respect to flushing, testing, and tie-in to the existing water distribution system.

1. Prevent contaminating materials from entering the water main during storage, construction, or repair.
2. Remove, by flushing or other means, those materials that may have entered the water main. .
3. Chlorinate any residual contamination that may remain, and flush the chlorinated water from the main.
4. Protect the existing distribution system from backflow due to hydrostatic pressure test and disinfection procedures.
5. Determine the bacteriological quality by laboratory test after disinfection.
6. Make final connection of the approved new water main to the active distribution system.

B. Filling and Testing Procedures

1. Connection for the new water main to the existing distribution system for filling and testing shall be through a Contractor furnished flushing mechanism. The Contractor is to furnish the single gate valve, double check valve flushing assembly and all necessary fittings, reducers, increases and sleeves to make the piping connections. Assembly shall be approved by the responsible water authority prior to its use. A suitable valved piping arrangement for the addition of the water-chlorine solution is to be available on the new line side of the flushing assembly. The assembly is to be furnished with 125 psi rated flange connections and installed in a manner approved by the Architect or Inspector.
2. Initial Flushing

a) The main shall be flushed prior to disinfection at a velocity of not less than 2.5 ft/s unless the responsible water authority determines that conditions will not permit the required flow. Adequate provision shall be made by the Contractor for disposals and neutralization of flushing water so that no physical or environmental damage results. Backflow prevention and initial flushing shall be in accordance with the following table.

| Main Size (Nominal) | Double Check Valve Single Gate Size | INITIAL FLUSH Min. Flow (gpm) |
|---|---|---|
| 6" | 4" | 220 |
| 8" | 4" | 400 |
| 12" | 6" | 900 |
| 16" | 6" | 1500 |
| 20" | 8" | 2450 |
| 24" | 10" | 3525 |

b) Since the large volume of water may have effects on the existing distribution system, the initial flushing is to be done only when the approval of and under the direction of the Architect or

Inspector. System demands may cause this flushing to be done at times when the existing distribution system demands are low.

c) Because of the large volume of water to be flushed from the fire hydrants or flushing hydrants, the Contractor must inspect the areas of discharge and provide the necessary equipment or materials to prevent any environmental damage or erosion. Sufficient hose length and termination fitting are to be provided so as to discharge the water into stable, heavily vegetated areas, drainage ponds, storm sewers, paved ditches, etc. The Contractor is to be responsible for any damage that may result from flushing.

3. Forms of Chlorine for Disinfection

It is the Contractor's responsibility to be familiar with and have available for his employees the "Product Data Safety Sheets" of any products used as a source of chlorine and to provide the proper safety instructions and personal protective equipment to the employees mixing and using materials for disinfection of the water facilities.

a) Acceptable sources of chlorine for disinfection may be obtained from any of the following three sources:

i. Liquid sodium hypochlorite (household bleach).

ii. Liquid sodium hypochlorite (industrial strength).

iii. Calcium hypochlorite granules.

Sources of chlorine shall be in conformance with AWWA B300 Standard for Hypochlorites, and NSF 60 and 61.

b) The direct introduction of chlorine liquid from a pressure cylinder into a waterline is not safe and shall not be allowed.

c) The mixing of a source of chlorine to obtain a suitable disinfection solution shall be as follows:

i. Liquid sodium hypochlorite is supplied in strengths from 5.25 percent available chlorine (commercially available household bleach) to 15 percent available chlorine (industrial strength sodium hypochlorite). A water-sodium hypochlorite solution shall be prepared by adding liquid sodium hypochlorite to water.

ii. A water calcium hypochlorite solution shall be prepared by dissolving calcium hypochlorite granules containing 65% available chlorine by weight in a pre-determined volume of water to make the desired water-calcium hypochlorite concentration. Disinfection of new mains by water calcium hypochlorite solution shall not be used unless a suction or in-line strainer is available on the solution pump to prevent any undissolved solids from entering the piping. An alternative method of straining the solution to remove undissolved granules may be approved by the Architect or Inspector on a case-by-case basis.

4. Method of Chlorine Application and Testing

a) The continuous feed method of applying the disinfecting solution shall be as follows: Water from the existing distribution system or other approved sources of potable water supply shall flow through a flushing mechanism as indicated on the contract drawings at a constant, measured rate into the newly-laid pipeline. The water shall be mixed with a chlorine-water solution as prepared above, also fed at a constant, measured rate. The two rates shall be proportioned so that the chlorine concentration of the water and water/chlorine solution in the pipe is elevated to and maintained at, a minimum of 50mg/l available chlorine.

b) Since the forms of preparation for a water-sodium hypochlorite or water-calcium hypochlorite concentration are a batch process, a method acceptable to the Architect or Inspector shall be

available to replenish the concentration being fed and mixed with the water flow, so there is no interruption of the flow of disinfection solution.

c) To assure that this concentration is maintained, the chlorine residual shall be measured at intervals not exceeding 2,000 feet and at the end of all branch lines or cul-de-sacs in accordance with procedures outline herein. During the application of the chlorine-water solution, valves, hydrants and any other appurtenances shall be operated in order to be thoroughly disinfected. Chlorine-water solution application shall continue until the entire new main is filled with water having a residual of a minimum of 50 mg/l chlorine solution. The chlorinated water shall be retained in the main for at least 24 hours. The free chlorine residual must be at least 10 mg/l after 24 hours in accordance with AWWA C651.

d) After the applicable retention period, the heavily chlorinated water shall be flushed from the main until the chlorine residual of the water leaving the main is equal to the chlorine residual of the incoming system water. At that time, the new system shall be valved off to allow the residual to dissipate to 0.2 mg/l before taking samples for bacteriological analysis.

5. Flushing

a) Flush to remove disinfecting solution. This is a low velocity, low flow, flush through fire or flushing hydrants to remove the disinfecting solution from the new line. The use of a neutralizing chemical and piping arrangement is required. The expense of a neutralizing station is the responsibility of the Contractor.

b) The final flush is a medium velocity, medium flow flush to clear the line of any chlorine solution used in the tie-in and to provide for fresh water throughout the new lines. Final flushing shall be in accordance with the following table.

| Main Size (Nominal) | FINAL FLUSH Max. Flow (gpm) |
|---|---|
| 6” | 88 |
| 8” | 160 |
| 12” | 350 |
| 16” | 624 |
| 20” | 978 |
| 24” | 1410 |

6. Bacteriological Tests

a) Bacteriological samples will be taken in accordance with AWWA C651, Section 7.

b) Bacteriological samples following water main disinfection must be analyzed by a state approved laboratory per Rule .1001 of the Rules Governing Public Water Systems.

1. All interior surfaces of new potable water supply systems, including wells, filters, storage tanks and distribution lines shall be thoroughly disinfected by means of hypochlorite or chlorine solutions, after which bacteriological test samples shall be collected.

2. After disinfection the water supply shall not be placed into service until bacteriological test results of representative water samples analyzed in an approved laboratory are found to be satisfactory.

c) After final flushing, and before the water main is placed in service, samples shall be collected and tested for bacteriological quality. Two consecutive negative tests from the same location shall show the absence of coliform organisms. At least two samples shall be collected by the responsible water authority at least 24 hours apart at intervals determined by the Architect or

Inspector (not exceed 2,000 feet apart and at the end of all branch lines) and tested by a qualified laboratory selected by the responsible water authority. The responsible water authority shall bill the Contractor a standard fee for this service including all retests.

d) Samples for bacteriological analysis shall be collected in approved sterile bottles or bags treaded with sodium thiosulfate. If laboratory results indicate the presence of coliform bacteria, the samples are unsatisfactory and disinfection shall be repeated as prescribed above until the samples are satisfactory. Cleaning, disinfection and testing shall be under the direction of the Architect or Inspector but remains the responsibility of the Contractor. The Contractor shall be responsible for any cost associated with the loading, hauling, discharging and dechlorination of the heavily chlorinated water.

e) A sampling tap consisting of a corporation cock with metal pipe shall be installed within two feet of valves. The corporation stop inlet shall be male one inch in size and the outlet shall have one inch I.P. threads and a cap.

f) After receiving satisfactory bacteriological test results, the Contractor shall coordinate with the Inspector the connecting of the new main to the existing system. All connecting pipe and fittings shall be clean and free of debris and shall be swabbed or sprayed with a 1 percent sodium hypochlorite solution before they are installed.

END OF SECTION 33 1000

# SECTION 33 3000 - SANITARY SEWERAGE

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

B. The State and Local Public Utilities Standards (latest Edition, Addenda, and approved materials list).

C. Reference Specifications are referred to by abbreviation as follows:

| | |
|---|---|
| 1. American National Standards Institute | ANSI |
| 2. American Society for Testing and Materials | ASTM |
| 3. American Water Works Association | AWWA |
| 4. National Bureau of Standards | NBS |
| 5. North Carolina Department of Transportation | NCDOT |
| 6. North Carolina Department of Environmental Health | NCDEH |

### 1.2 SUMMARY

A. This Section includes sanitary sewerage system piping and appurtenances from a point 5 feet outside the building to the point of disposal or to the connection point into the existing municipal wastewater system.

### 1.3 SUBMITTALS

A. Submit shop drawings and/or product data for the following:

1. Pipe and pipe lining
2. Fittings
3. Special Pipe Couplings
4. Manholes and Accessories
    a) Flexible pipe connectors
    b) Frame and covers
    c) Adjusting rings
    d) Entry seals
    e) Vent piping
    f) Frame-to-manhole sealant
    g) Steps

h) Exterior coatings

i) Interior protective linings and coatings

5. Steel Encasement Pipe
6. Casing Spacers and End-seals
7. Detectable Marking Tape
8. Cleanouts
9. Bedding Stone (NCDOT approved job-mix formula)

B. Certification provided by the contractor that all materials and sewage piping have been tested and meet the provisions of the contract documents.

## 1.4 QUALITY ASSURANCE

A. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to sanitary sewerage systems, and to the requirements of the latest edition of the North Carolina Erosion and Sediment Control Planning and Design Manual for erosion control during installation.

B. Utility Compliance: Comply with the requirements of State and Local Public Utilities' Standards (latest Edition, Addenda, and approved materials list).

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Prepare materials for shipping and transsport as follows:

1. Ensure materials are dry and internally protected against rust and corrosion.
2. Protect materials against damage to threaded ends, flange faces, pipe bells and spigots, and coatings.
3. Set materials in best position for handling to prevent rattling.

B. Storage: Use the following precautions for materials during storage:

1. Do not remove end protectors unless necessary for inspection, and reinstall for storage.
2. Protect materials from weather, moisture and dirt. If outdoor storage is necessary, elevate and support materials off the ground or pavement in watertight enclosures.
3. Store pipe in accordance with manufacturer's recommendations. Do not store plastic structures, pipe, and fittings in direct sunlight. Support materials to prevent sagging and bending.

C. Handling: Handle materials on-site to prevent damage.

1. Handle materials to prevent interior and exterior coating and pipe-end damage, and to prevent the entrance of dirt, debris, and moisture.
2. Handle pre-cast concrete manholes and other structures according to manufacturer's written rigging instructions.
3. If any portion of piping and fittings is damaged, repairs should be made in accordance with manufacturer's recommendations prior to installation.

1.6 PROJECT CONDITIONS

A. Site Information: Perform site survey to verify existing utility locations. Verify that sanitary sewerage system piping may be installed in compliance with the design and referenced standards.

B. Locate existing structures and piping to be closed and abandoned.

C. Existing Utilities: The location of existing utilities, including underground utilities, is indicated on the drawings insofar as their existence and location were known at the time of preparation of the drawings. However, nothing in these Contract Documents shall be construed as a guarantee that such utilities are in the location indicated or that they actually exist, or that other utilities are not within the area of operations. The Contractor shall make all necessary investigations to determine the existence and locations of such utilities far enough in advance of pipe laying to allow for adjustments due to conflicts in the horizontal and vertical positions of the pipeline.

1. Do not proceed with utility interruptions without receiving Architect's written permission.
2. Notify Architect not less than 48 hours in advance of proposed utility interruptions.
3. Do not interrupt existing utilities serving facilities occupied by others except when permitted by the utility owner and after arranging to provide acceptable temporary utility services.
4. Existing utilities across or along the line of work are indicated only in an appoximate location. Locate all underground lines and structures. Call "NC one call" at 1-800-632-4949 prior to construction. If utilities are marked that are not shown on the plans, locate utility vertically and horizontally and provide information to architect. The contractor shall pay for any damage to and for maintenance and protection of existing utilities and structures.

D. Connections to Existing System:

1. Before the start of the construction, the Contractor shall dig test pits on all crossings of and connections to the existing system, as applicable, to determine the existing system location, size, and piping material. If the location, size, and piping material differs from that shown on the Drawings, notify Engineer immediately.
2. The Contractor shall make connections to the existing system under a pressure or non-presure condition, as indicated, complying with the system owner's requirements for the time of day such work can be done. The Contractor shall pay all costs associated with the connections unless otherwise indicated. If the system owner performs the work, the Contractor shall arrange for the work to be done.
3. Valves are to be operated only by the Owner.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate with interior building sanitary drainage piping.

B. Coordinate with other utility work.

C. Utility interruptions shall be coordinated with local utility provider. Written notice 48 hours in advance of utility interruption shall be provided to all affected customers.

PART 2 - PRODUCTS

2.1 PIPE AND PIPE LINING

A. General: Provide pipe materials and fittings compatible with each other. All materials shall comply with the requirements of the State and Local Public Utilities' Standards (latest Edition, Addenda, and approved materials list).

B. Gravity Sewer Pipe:

1. Polyvinylchloride (PVC) Sewer:

a) Polyvinylchloride (PVC) non-pressure pipe (4"-15") shall meet requirements of ASTM D3034, Type PSM, SDR-35 with elastometric gasket joints meeting requirements of ASTM D3212. Bedding shall be as shown on the construction plans.

b) Polyvinylchloride (PVC) non-pressure pipe (18"- 48") shall meet requirements of ASTM F679, Table I, Type SDR-35 for large diameter solid wall PVC pipe with elastrometric gasket joints meeting requirements of ASTM D3212. Cell classification for sewer pipe shall be 12454-B or 12364-C. Bedding shall be as shown on the construction plans.

c) Polyvinylchloride (PVC) non-pressure profile pipe (21" and larger) shall meet requirements of ASTM F794 with elastometric gasket joints meeting requirements of ASTM D3212. Bedding shall be as shown on the construction plans.

2. Ductile Iron (DI) Sewer:

a) Ductile iron (DI) non-pressure pipe shall meet requirements of AWWA C151. Pipe shall be thickness Class 52. Pipe shall have cement-mortar lining and a bituminous seal coat. Thickness classes shall meet requirement of AWWA C150.

b) Mechanical joints and jointing material shall meet requirements of AWWA/ANSI C111/A21.11.

c) Flanged joints for ductile iron pipe shall meet requirements of ANSI B16.1. Flanged joint gaskets shall be full face, made of 1/16-inch thick rubber, and shall meet the requirements of ANSI B16.21.

d) Push on joint and rubber gasket shall meet requirements of AWWA C111.

e) Cement mortar lining with bituminous seal coat for ductile iron pipe and fittings shall meet requirements of AWWA/ANSI C104/A21.4.

f) Cement mortar lining shall be standard thickness.

g) Exterior, bituminous coating for ductile iron pipe shall meet requirements of AWWA/ANSI C106/A21.6 or AWWA/ANSI C151/A21.51 as applicable.

2.2 FITTINGS

A. General: Provide pipe fitting materials compatible with each other. All materials shall comply with the requirements of State and Local Public Utilities' Standards (latest Edition, Addenda, and approved materials list).

B. Polyvinylchloride (PVC) Gravity Sewer:

1. Polyvinylchloride (PVC) non-pressure fittings (4"-15") shall meet requirements of ASTM D3034, Type PSM, SDR-35 with elastrometric gasket joints meeting requirements of ASTM D3212.

2. Polyvinylchloride (PVC) non-pressure fittings (18”- 48”) shall meet requirements of ASTM F679, Table I Type SDR-35 for large diameter solid wall PVC pipe with elastrometric gasket joints meeting requirements of ASTM D3212.
3. Polyvinylchloride (PVC) non-pressure fittings (21” and larger) shall meet the requirements of ASTM 3034, SDR-35, PVC for large diameter profile sewer pipe with elastrometric gasket joints meeting requirements of ASTM D3212.

C. Ductile Iron (DI) Gravity Sewer:

1. Fittings shall be ductile iron. Ductile iron fittings shall meet requirements of AWWA C110. Pressure ratings shall be a minimum of 350 psi for all fittings. Fittings shall have cement-mortar lining and a bituminous seal coat.
2. Gaskets: ASTM F 477, elastometric seal.
3. Standard-Pattern, Ductile-Iron Fittings: AWWA C110, for push-on joints.
4. Compact-Pattern, Ductile-Iron Fittings: AWWA C153, for push-on joints.
5. Fitting Interior Coating: AWWA C104, asphaltic-material seal coat, minimum 1-mil (0.025-mm) thickness.
6. Mechanical joints and jointing materials shall meet requirements of AWWA C111.
    a) Mechanical joint retainer glands shall meet requirements of AWWA C111. Retainer gland shall be fitted with setscrews.
    b) Metal harness shall be galvanized rods and clamps as detailed on Drawings.
    c) Provide systems called for (or equals) as required on the drawings for restrained joints on aerial pipe.

D. Sewer Saddles:

1. Applies to taps for service lines of 4 inches or 6 inches on main line pipe up to 12 inches.
2. Straps shall be stainless steel, 24-guage, 2.5 inches wide
3. Nuts and bolts shall be stainless steel, 3/8-inch diameter.
4. Saddle shall be coated cast iron, with tubular rubber gasket.
5. Adapter compatible with service line shall be secured to saddle with PVC sleeve.
6. Sewer saddles shall be as manufactured by one of the following:.
    a) ROMAC Industries, Inc
    b) GENCO (The General Engineering Co.)
    c) Inserta Fittings Company

## 2.3 SPECIAL PIPE COUPLINGS

A. Use flexible pipe couplings where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.

1. Use the following pipe couplings for non-pressure applications:
    a) Sleeve type to join piping, of same size, or with small difference in OD.

b) Increaser/reducer-pattern, sleeve type to join piping of different sizes. Sleeve type shall be of the eccentric pattern.

## 2.4 MANHOLES AND ACCESSORIES

A. General

1. Manholes shall be constructed of pre-cast reinforced concrete manhole sections in accordance with the requirements of ASTM C478 and detailed on the construction plans.
2. A maximum of two lift holes per manhole section may be provided.
3. Provide tongue and groove joints in manhole sections with a preformed groove in the tongue for placement of an O-ring type round, rubber gasket, or Press Seal, Inc.'s Profile RS gasket.
   a) Gasket shall comply with requirements of ASTM C443.
   b) Gasket shall seal the joint from either internal or external hydrostatic pressure.

B. Flexible Pipe Connectors: Provide flexible pipe connections to manholes, other than acid-resistant manholes, for pipes 24 inches and smaller in size.

1. Materials shall be resistant to water, sewage, acids, ozone, weathering and aging. Connectors shall conform to the requirements of ASTM C923. Use neoprene conforming to ASTM C443 and stainless steel, Series 300.
2. Cast or core drill openings in manholes to receive connectors. Connectors shall be suitable for field repair or replacement. Connectors not suitable for field replacement are unacceptable.
3. The assembled connectors shall allow at least an 11° angular deflection of the pipe and at least one inch of lateral misalignment in any direction and be suitable for a normal variation in diameter or roundness for the pipe material used.
4. Connectors shall be similar to Kor-N-Seal as manufactured by NPC, Inc.

C. Frames and Covers: Manhole frames and covers shall be molded of gray cast iron conforming to ASTM A48, Class 30. Castings shall be coated with a coal tar pitch varnish, to which sufficient oil has been added to make a smooth coating that is not tacky or brittle. Seating surfaces between frame and cover shall be machined. Manhole frame and covers shall be one of the following, or equivalent:

1. Street Type
   a) Neenah Foundry
   b) Capitol Foundry
   c) Sigma Corporation
   d) East Jordan Iron Works
2. Watertight
   a) Capitol Foundry
   b) East Jordan Iron Works
3. Vandal Proof
   a) Neenah Foundry

b) Capitol Foundry

D. Adjusting Rings: Adjusting rings shall be made of reinforced concrete or HDPE (as manufactured by LadTech, Inc.). Brick, block and mortar construction shall not be permitted in lieu of rings. Rings shall be of required thickness to obtain the desired top elevation and match the diameter of the frame and cover. Any combination of adjustment rings shall not exceed a total thickness of 9 inches.

E. Entry Seals: Entry seals shall be furnished on all sanitary sewer manholes. Entry seals may be installed on the interior of the manhole using Cretex Specialty Products' "Chimney Seal" or on the exterior of the manhole using Canosa's "Wrapid Seal," or approved equivalents.

F. Vent Piping: Vent piping shall be installed in accordance with the details shown on the construction drawings.

G. Frame-to-Manhole Sealant: Sealant for manhole frames shall be a one-component polyurethane sealant similar to Sika "Sikaflex" Type 1a.

H. Steps: Manhole steps shall be corrosion-resistant and shall be one-half inch grade 60 steel reinforcing rod encapsulated in a copolymer polypropylene. The steps shall conform with ASTM C478 paragraph 11 and to the dimensions shown on the Standard Details.

I. Exterior Coating: Exterior of manhole to be coated with bitumastic waterproofing.

J. Interior Product Linings and Coatings

1. Interior protective linings and coatings shall provide resistance to deterioration due to hydrogen sulfide ($H_2S$) and by-products thereof. Selected system of liners, coatings or admixture shall include provisions to protect concrete and all discontinuities including precast joints, pipe penetrations, seams, and entryways.

2. Liners: Liners for acid-resistant manholes shall be of High Density polyethylene (HDPE), Polypropylene Random Copolymer (PP-R) or polyvinylchloride (PVC) construction and shall be installed to protect the pre-cast manhole sections from the inside base of the manhole to the base of the manhole cover frame. Benches and inverts for lined manholes shall be coated as specified for coated manholes.

a) HDPE or PP-R liners shall consist of a 2mm thick HDPE (high density polyethylene) or Polypropylene Random copolymer (PP-R) with a large number of anchoring studs (a minimum of 420/$m^2$, 39/$ft^2$), manufactured during he extrusion process in one piece with the sheet so there is no welding and no mechanical finishing work to attach the studs to the sheet. Liner shall be similar to AGRU Sure Grip®. Joints between sections of the liner shall be sealed in accordance with the manufacturer's instructions.

b) PVC liners shall consist of polyvinylchloride plates, not less than 0.060 in. thick, with integral bonding ribs and shall be similar to Amercoat "T-Lock Amer-Plate." Joints between sections of liner shall be welded in accordance with the manufacturer's instructions.

3. Coatings: Coatings for proposed and existing manholes shall be Raven Lining System epoxy coatings or approved equivalent.

4. Admixtures: Admixtures for use in concrete manholes shall be ConShield™ or approved equivalent.

## 2.5 STEEL ENCASEMENT PIPE

A. Steel pipe shall be welded or seamless, smooth wall consisting of Grade “B” steel as specified in ASTM A-139. Spiral welded steel pipe is not permissible.

B. Minimum yield strength shall be 35,000 psi, and pipe thickness shall be as specified on the construction plans.

C. All pipe shall be furnished with beveled ends prepared for field welding of circumferential joints. All burrs at pipe ends shall be removed.

D. Encasement pipe must be approved by the appropriate controlling agency (NCDOT, R.R., etc.) and the Architect prior to ordering.

## 2.6 CASING SPACERS AND END-SEALS

A. Casing Spacers:

1. Casing Spacers shall be one of the following:

a) Cascade

b) Advance Products & Systems, Inc. Model SI

c) Pipeline Seal and Insulator, Inc. Model No. C8G-2, Model No. C12G-2

2. Casing spacers shall be centered and restrained unless otherwise shown on the drawings.

B. End-Seals:

1. End-Seals shall be one of the following:

a) Advance Products & Systems, Inc. Model AC

b) Pipeline Seal and Insulator, Inc. Model C

## 2.7 DETECTABLE MARKING TAPE

A. Detectable marking tape shall be installed above all gravity sewer (including all service laterals).

B. Plastic marking tape shall consist of one layer of aluminum foil laminated between two layers of inert plastic film. Tape shall be resistant to alkalis, acids and other destructive agents commonly found in the soil. The laminate shall be strong enough that the layers cannot be separated by hand.

C. Tape shall be a minimum of 4-1/2 mils thick with a minimum tensile strength of 60 lbs. in the machine direction and 58 lbs. in the transverse direction per 3" wide strip. Tape color shall be APWA Color Coded for marking the particular utility line and shall be imprinted with a continuous warning message to indicate the type of utility being marked, the message normally being repeated every 16” to 36". Tape shall be inductively locatable and conductively traceable using a standard pipe and cable-locating device. Tape shall be 3" wide Terra Tape "Sentry Line Detectable 620," or approved equivalent.

## 2.8 CLEANOUTS

A. General: Provide cast-iron ferrule and countersunk brass cleanout plug, with round cast-iron access frame heavy-duty, secured, scoriated cast-iron cover.

B. Sewer pipe fitting and riser to cleanout shall be the same material as the run of pipe for which it serves.

## PART 3 – EXECUTION

### 3.1. SEPARATION OF WATER LINES AND SANITARY AND/OR COMBINED SEWERS

A. Follow State Health Department Standards for the separation of sanitary sewer and water distribution systems.

B. Parallel Installation

1. Normal Conditions - Sewer lines and manholes shall be constructed at least 10 feet horizontally from a waterline whenever possible. The distance shall be measured edge-to-edge.

2. Unusual Conditions - When local conditions prevent a horizontal separation of at least 10 feet, then maximum horizontal separation shall be provided with vertical separation of bottom of waterline at least 18 inches above top of sewer. Where this vertical separation cannot be obtained, the sewer shall be constructed of AWWA approved water pipe pressure-tested in place to 5 psi without leakage prior to backfilling. The sewer manhole shall be of watertight construction and tested in place.

C. Crossing:

1. Normal Conditions - Sewers crossing under waterlines shall be laid to provide a separation of at least 18 inches between the bottom of the waterline and the top of the sewer whenever possible.

2. Unusual Conditions - When local conditions prevent a vertical separation described in Crossing, Normal Conditions, paragraph above, the following construction shall be used:

a) Sewers passing over or under waterlines shall be constructed of ductile iron pipe with mechanical joints as described in Parallel Installation, Unusual Conditions above.

b) Sewers passing over waterlines shall be laid to provide:

i. Adequate structural support for the sewers to prevent excessive deflection of the joints and settling on and breaking waterline.

ii. Maximum separation of water and sewer line joints.

D. Sanitary and/or combined sewers or sewer manholes - No water pipes shall pass through or come in contact with any part of a sewer or sewer manhole.

### 3.2. EXCAVATING AND BACKFILLING

A. Excavation, trenching, backfilling and bedding for all piping specified herein shall conform to the applicable requirements of the NCDOT Standard Specifications for Roads and Structures and/or to details shown on the construction plans.

B. Remove any and all materials encountered in the course of excavating for all underground utility systems. After the pipe is in place, backfill with suitable material, free from frozen earth, rocks, and organic materials.

1. Provide all necessary shoring required for the protection of excavations, existing utilities and workmen and do all necessary pumping required to keep excavation and pipe free from water from any source at all times.
2. Provide sufficient barricades adjacent to excavations to safeguard against injury to workmen and the public. Provide and maintain sufficient warning lanterns at walks, roadways, and parking areas to provide safety at all times.
3. Where roots of live trees are encountered in excavations, they shall be carefully protected during construction.
4. Exercise special care in backfilling trenches to guard against disturbing the joints.
5. Remove and dispose of any material not used for backfill.

C. Removal of subsurface obstructions which are uncovered during excavation for installation of the sanitary sewer systems shall be by the Contractor at his expense. This shall include removal of existing concrete or brick from existing building foundations, footings, abandoned utility piping, wires, structures, rock boulders, etc., which may not be visible from surface investigations before construction, but will interfere with new installations. If such obstructions are encountered, they shall be removed two feet from around the area of new work and the excavation backfilled with a suitable material as specified.

## 3.3. PIPE HANDLING

A. Take all precautions to ensure that pipe, fittings, and related items are not damaged in unloading, handling and placing in trench. Examine each piece of material just prior to installations to determine that no damage has occurred. Remove any damaged material from the site and replace with undamaged material.

B. Keep pipe clean. Exercise care to keep foreign material and dirt from entering pipe during storage, handling and placing in trench. Close ends of in-place pipe at the end of any work period to prevent entry of animals and foreign material.

C. Survey Line and Grade

1. Line and grade hubs shall be set by a registered surveyor, maintained by the Contractor, and the Architect provided with cut-sheets.
2. Contractor shall have level or transit in good working order on the job set up at all times to periodically check line and grade of pipe.

## 3.4. GRAVITY SEWER PIPE LAYING

A. Laying of sewer pipe shall be accomplished to line and grade as indicated on the contract drawings and in the trench only after it has been dewatered and the foundation and/or bedding has been prepared. Mud, silt, gravel, and other foreign material shall be kept out of the pipe and off the jointing surfaces. Do not lay pipe when weather or trench conditions are unsuitable.

B. Pipe and fittings shall be strung out along the route of construction with the bells facing in the direction in which the work is to proceed. Pipe shall be placed where it will cause the least interference with traffic. Laying of the pipe shall be commenced immediately after the excavation is started and every means must be used to keep pipe laying closely behind the trenching. The Engineer may stop the trenching when, in his opinion, the trench is open too far in advance of the pipe laying operation. The bottom of the sewer trench shall be shaped to give

substantially uniform circumferential support to the lower on-third of each pipe. Holes shall be scooped out where the bells occur leaving the entire barrel of the pipe bearing on the pipe bed.

C. All pipe laid shall be retained in position so as to maintain alignment and joint closure until sufficient backfill has been completed to adequately hold the pipe in place. All pipe shall be laid to conform to the prescribed line and grade shown on the contract drawings. After completion the pipe shall exhibit a full circle of light at one manhole when viewed from the next.

D. The sewer pipe shall be laid upgrade from point of connection to the existing sewer or from a designated starting point. If the starting point is at an existing stub, it shall be removed and a full length of pipe installed. The sewer pipe shall be installed with the bell end forward or upgrade. When pipe laying is not in progress, the forward end of the pipe shall be kept tightly closed with a water tight plug or cap. When the upstream end of a sewer does not terminate at a manhole, it shall be plugged and its location marked in a manner approved by the Inspector.

E. The pipe shall be fitted and matched so that when installed it will form a smooth, uniform invert.

F. Prior to joining the pipe, all surfaces of the pipe to be joined and the surfaces of factory made jointing materials shall be clean and dry. Lubricants, primers, adhesives, etc., shall be applied and the pipes joined as recommended by the manufacturer's specifications. Sufficient pressure shall be applied in making the joint to assure that the pipe is "home". The interior of the pipe shall be cleaned of all foreign material as the work progresses. At the end of the work day, the last pipe laid shall be blocked to prevent creep, and closed with a water tight plug or cap.

G. Joining Pipe

1. Ductile iron pipe is to be joined in accordance with the requirements of AWWA Standard C600 and the manufacturer's recommendations.
2. Polyvinyl chloride (PVC) pipe shall be joined in accordance with ASTM Standard D-2321.
3. Other type pipe shall be joined in accordance with the manufacturer's recommendations and the requirements of the County approved plans and specifications.

H. All visible leaks shall be corrected prior to testing.

## 3.5. MANHOLES

A. Manholes shall be constructed to the elevations shown on the Contract Drawings in accordance with the provisions of the Standard Details.

B. Set manhole base section on bed of NCDOT #57 stone to a minimum depth of 8 in. Stone shall be thoroughly compacted and carefully leveled to the excavated earth wall.

C. Join all manhole riser and cone or flat slab top sections by the use of an approved rubber gasket.

D. Pack and brush joints in FRP lining in acid-resistant manholes with sealant to provide a watertight and acid-resistant seal. Field weld joints in PVC lining of acid-resistant manholes in accordance with manufacturer's instructions.

E. Install pipe stubs in manholes where called for on the Contract Drawings. All stubs shall be sealed watertight with a plug or cap at both ends.

F. Install flexible manhole connections for all pipes sizes 4 in. to 24 in., inclusive, and apply sealant to completely fill joint between manhole barrel and flexible connection for the full thickness of the manhole barrel.

G. Plug lift holes and repair any defects in manhole.

H. Adjusting Rings: Include two or three adjusting rings, of 6-to-9-inch total thickness that match diameter of frame and cover.

I. Set manhole frame in bed of sealant. Bed shall consist of one, 3/8 in. bead laid flush with the inside edge of the frame base and another 3/8 in. bead laid flush with the outside edge of the frame base.

J. Construct bench of concrete or brick and mortar.

1. Lowest elevation of bench shall be at the spring line of the outgoing pipe.
2. Slope bench three inches toward channel for drainage.
3. Where stubs or knockouts are provided for future pipe connections, bench shall be so formed.
4. Use sulfate resistant cement for concrete or mortar on all acid-resistant manholes.
5. Where sealant is used, bench shall not be in contact with pipe or flexible pipe connection.

K. Existing Manhole Tie-In

1. Core drilling and a flexible pipe-to-manhole connector shall be used in the connection of the sewer pipe to precast manholes, where stubs or bricked up opening do no exist.
2. The connector shall be Kor-N-Seal assembly or approved equal.
3. The connector shall be installed in the manhole wall by activating the expanding mechanism in strict accordance with the recommendation of the connector manufacturer.
4. The connector shall be of a size specifically designed for the pipe material and size being utilized on the project. All materials must conform to the approved products reflected in these standards.
5. Where bricked up opening exits, a PVC manhole adapter shall be used in the connection of the sewer pipe to precise manholes and installed using the proper conventional methods such as the process established for the “GPK PVC Manhole Adapters” or approved equal.

## 3.6. DETECTABLE MARKING TAPE

A. Install detectable marking tape in all trenches containing buried, non-metallic, pipelines. Tape shall be installed in all trenches with a cover of 18” to 54" and a minimum clearance over the pipelines of 18". Tape shall be made electrically conductive throughout the entire system through the use of splices of a type recommended by the manufacturer.

## 3.7. ROAD/HIGHWAY CROSSINGS

A. Where crossing is to be installed beneath a North Carolina road or highway, all operations and materials shall conform to the requirements of the North Carolina Department of Transportation governing such crossings, and the contractor shall obtain approval of all materials and methods to be employed before such work is started. A copy of such permission shall be filed with the Owner prior to starting the work. The contractor will also be required to furnish a release from the proper authorities before final acceptance of the work by the Owner. The contractor shall secure from the Department of Transportation the necessary information regarding proper bracing, sheeting, shoring and other required protection of the highway and traffic during the construction operation. Where an open cut is permissible in crossing the State Highway instead

of boring, the contractor shall make the necessary provisions for handling traffic and replacing the roadbed and surface as required by the North Carolina Department of Transportation. Contractor shall be responsible for the payment of all fees required to obtain the necessary permits

3.8. CLEAN UP

A. Upon the completion of the installation of the sanitary sewer system and prior to acceptance, sediment and debris shall be removed from the limits of construction. All trash and debris shall be removed and properly disposed of. Areas not otherwise stabilized shall be seeded and mulched and a good stand of grass established.

3.9. AS BUILT SURVEY

A. Provide the owner an as built survey to include all manhole rims, pipe inverts, and service cleanouts for NCDENR certification. Also provide an as built survey of storm sewer and utilities crossing the sanitary sewer line to verify depth of clearances to the sanitary sewer line.

PART 4 -TESTING

A. Gravity Sewers

1. All testing shall be in accordance with NCDENR standards.
2. Testing of gravity sewer lines shall be conducted on short sections of sewer line, i.e., between manholes. Provide all labor, materials, tools, and equipment necessary to make the tests, and ensure that zero infiltration is provided. All equipment and methods used shall be acceptable to the Engineer and the Owner. All monitoring gages shall be subject to calibration, if deemed necessary.
3. Deflection tests shall be performed on all pipe installations. The test shall be conducted after the final backfill has been in place at least 30 days to permit stabilization of the soil-pipe system. As an alternative to waiting 30 days to permit stabilization of the soil-pipe system, the Division will accept certification from a soil testing firm verifying that the backfill of the trench has been compacted to at least 95% maximum density.
4. No pipe shall exceed a deflection of 5 percent. If deflection exceeds 5 percent, replacement or correction shall be accomplished in accordance with requirements in the approved specifications.
5. The rigid ball or mandrel used for the deflection test shall have a diameter not less than 95 percent of the base inside diameter or average inside diameter of the pipe depending on which is specified in the ASTM Specification, to which the pipe is manufactured. The pipe shall be measured in compliance with ASTM D 2122 Standard Test Method of Determining Dimensions of Thermoplastic Pipe and Fittings. The test shall be performed without mechanical pulling devices.
6. Sanitary sewer lines 24 in. diameter and smaller shall be tested after backfill using a low-pressure air test in accordance with ASTM C924.
7. Summary of Method: Plug the section of the sewer line to be tested. One of the plugs used at the manhole must be tapped and equipped for the air inlet connection for filling the line from

the air compressor. Introduce low-pressure air into the plugged line. Use the quantity and rate of air loss to determine the acceptability of the section being tested.

8. Preparation of the sewer line: Flush and clean the sewer line prior to testing, thus serving to wet the pipe surface as well as clean out any debris. A wetted interior pipe surface will produce more consistent results. Plug all pipe outlets using approved pneumatic plugs with a sealing length equal to or greater than the diameter of the line being tested to resist the test pressure. Give special attention to laterals.
9. Groundwater Determination: Install a ½-inch capped galvanized pipe nipple, approximately 12 inches long, through the manhole on top of the lowest sewer line in the manhole. Immediately prior to the line acceptance test, the ground water elevation shall be determined by removing the pipe cap and blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic hose to the pipe nipple. The hose shall be held vertically and a measurement of the height in feet of water over the invert of the pipe shall be taken after the water has stopped rising in the plastic hose.
10. Procedures: Determine the test duration for the section under test by computation from the applicable formulas shown in ASTM C828. The pressure-holding time is based on an average holding pressure of 3 psi gage or a drop from 3.5 psi to 2.5 psi gage.
    a) Add air until the internal air pressure of the sewer line is raised to approximately 4.0 psi gage. After an internal pressure of approximately 4.0 psig is obtained, allow time for the air pressure to stabilize. The pressure will normally show some drop until the temperature of the air in the test section stabilizes.
    b) When the pressure has stabilized and is at or above the starting test pressure of 3.5 psi gage, commence the test. Before starting the test, the pressure may be allowed to drop to 3.5 psig. Record the drop in pressure for the test period. If the pressure has dropped more than 0.5 psi gage during the test period, the line shall be presumed to have failed. The test may be discontinued when the prescribed test time has been completed even though the 0.5 psig drop has not occurred.
    c) The test procedure may be used as a presumptive test, which enables the installer to determine the acceptability of the line prior to backfill and subsequent construction activities.
    d) If the pipe to be tested is submerged in ground water, the test pressure shall be increased to 1.0 psi for every 2.31 feet the ground water level is above the invert of the sewer.
11. Safety: The air test may be dangerous if, because of lack of understanding or carelessness, a line is improperly prepared.
    a) It is extremely important that the various plugs be installed and braced in such a way as to prevent blowouts. In as much as a force of 250 lbs. is exerted on an 8 inch plug by an internal pipe pressure of 5 psi, it should be realized that sudden expulsion of a poorly installed plug or of a plug that is partially deflated before the pipe pressure is released can be dangerous.
    b) As a safety precaution, pressurized equipment shall include a regulator or relief valve set at perhaps 10 psi to avoid over-pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing.

B. Manholes

1. Vacuum testing of manholes: Vacuum tests shall be conducted on newly constructed manholes following construction and after all connections have been made but before any backfilling

around the manhole. Successful testing shall be accomplished before any backfilling operations.

2. Provide necessary vacuum pump, pneumatic plugs and accessories required for proper performance of the test. Plugs shall have a sealing strength equal to or greater than the diameter of the connecting pipe to be sealed.
3. Follow all local, state and federal safety precautions. Brace inverts if lines entering the manhole have not been backfilled or otherwise restrained to prevent pipe from being dislodged and pulled into the manhole.
4. Install vacuum tester head assembly at the top access of the manhole. Adjust the cross brace to insure that the inflatable sealing element inflates and seals against the straight top section of the manhole if possible.
5. Attach the vacuum pump assembly to the proper connection on the test head assembly. Make sure the vacuum inlet/outlet valve is in the closed position.
6. Following safety precautions and testing equipment manufacturer's instructions, inflate sealing element to the recommended maximum inflation pressure. Do not over-inflate.
7. Start the vacuum pump assembly engine and allow preset pump to stabilize. Open the inlet/outlet ball valve and evacuate the manhole to 10" Hg (approximately - 5 psig). Pressurizing the manhole may result in damage to manhole or to test equipment.
8. Close vacuum inlet/outlet ball valve and monitor vacuum for specified test period (see table). If vacuum does not drop in excess of 1" Hg., manhole is considered acceptable and the manhole passes the test. If manhole fails the test, complete necessary repairs and repeat test procedures until satisfactory results are obtained.

4-FT. DIAMETER MANHOLE

| Manhole Depth | Minimum Elapsed Time for a Pressure Change of 1 Inch Hq |
|---|---|
| 10 Ft. or Less | 60 Seconds |
| Greater Than 10 Ft. But Less Than 15 Ft. | 75 Seconds |
| Greater than 15 Ft. But Less Than 25 Ft. | 90 Seconds |
| Greater Than 25 Ft. | Add 2 Seconds Per Foot of Additional Manhole Depth. |

For manholes five feet in diameter, add an Additional 15 seconds, and for manholes six feet in diameter, add an Additional 30 seconds to the time required for four-foot diameter manholes.

9. Repeat the above test procedure after backfilling manhole for final acceptance test.

END OF SECTION 33 3000

SECTION 33 4100 - STORM DRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 SUMMARY:

A. This Section includes the roof drainage collection system, the storm sewerage system piping and appurtenances from a point 5 feet outside the building to the point of disposal, and the outfall structures of the stormwater management basin.

1.3 SUBMITTALS

A. Product data for:

1. Concrete pipe
2. Polyethylene pipe
3. Ductile iron pipe
4. Frames and covers.
5. Grates
6. Couplings for connection into concrete pipe.

B. Certification, signed by material producer and contractor, that standard precast and cast in place concrete storm drainage manholes and Drop Inlets comply with NCDOT standards and specifications.

C. NCDOT approved job mix for bedding stone.

D. Shop drawings for:

1. Non-standard precast or cast-in-place concrete storm drainage manholes and Drop Inlets.
2. Trench drain system.
3. Cleanouts
4. Underdrains
5. Stormwater Management Basin Outlet structures, including: Riser pipe, outfall pipe, riser anchoring, anti-seep collars, trash rack and anti-vortex device.

E. Record drawings of installed storm drainage system.

1.4 QUALITY ASSURANCE

A. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to storm sewerage systems.

B. Utility Compliance: Comply with state and local regulations and standards pertaining to storm sewerage systems.

C. All materials shall be new and free of defects (i.e. pipe shall not have chipped spigots or bells).

1.5 PROJECT CONDITIONS

A. Site Information: Perform site surveys, research public utility records, and verify existing utility locations. Verify that storm sewerage system piping may be installed in compliance with original design and referenced standards.

B. Locate existing structures and piping to be closed and abandoned.

C. Existing Utilities: Do not interrupt existing storm sewer serving facilities occupied by the Owner of others except when permitted under the following conditions and then only after arranging to provide acceptable temporary storm sewer services.

1. Notify Architect not less than 48 hours in advance of proposed storm sewer interruptions.

2. Do not proceed with storm sewer interruptions without receiving Architect's written permission.

D. Existing utilities across or along the line of work are indicated only in an approximate location. Locate all underground lines and structures. Call "NC one call" at 1-800-632-4949 prior to construction. If utilities are marked that are not shown on the plans, locate utility vertically and horizontally and provide information to architect.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate with interior building storm drainage piping.

B. Coordinate with other utility work.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials used for construction of the storm sewerage system shall comply with the requirements of the latest edition of the North Carolina Department of Transportation Standard Specifications for Roads and Structures.

2.2 PIPE AND FITTINGS

A. Provide pipe and pipe fitting materials compatible with each other. Pipe materials are indicated on the drawings.

B. Reinforced Concrete Pipe (RCP): Shall conform to the requirements of ASTM C76/AASHTO M170, Class III, unless otherwise indicated.

C. O-Ring Gasket Reinforced Concrete Pipe: Shall conform to the requirements of ASTM C76/AASHTO M170, Class III, unless otherwise indicated. Joints shall conform to the requirements of ASTM C443/AASHTO M198.

D. Corrugated Polyethylene Pipe (P.E.): Shall have a smooth lined interior and meet the requirements of ASTM F405 or AASHTO M252 for 10" diameter and smaller, and ASTM F667 or AASHTO M294 for 12" diameter and larger.

E. PVC Storm Sewer Pipe: Shall conform to the requirements of ASTM D3034, SDR-35 with bell and spigot ends for gasketed joints with ASTM F 477 elastometric seals

a) Connections to the building downspouts shall be made with Schedule 40 PVC.

F. Ductile Iron Storm Sewer Pipe: Shall conform to the requirements of AWWA C151, Class 52. Flanged joints shall conform to the requirements of AWWA C115.

2.3 MANHOLES

A. Precast Concrete Manholes: Comply with the requirements of the latest edition of the North Carolina Department of Transportation Standard Specifications for Roads and Structures.

B. Cast-in-Place Manholes: Comply with the requirements of the latest edition of the North Carolina Department of Transportation Standard Specifications for Roads and Structures.

C. Manhole Steps, Safety Slabs and Inlet Shaping: Comply with the requirements of the latest edition of the North Carolina Department of Transportation Standard Specifications for Roads and Structures.

D. Manhole Frames and Covers: Comply with the requirements of the latest edition of the North Carolina Department of Transportation Standard Specifications for Roads and Structures.

2.4 CLEANOUTS

A. Cast-iron ferrule and countersunk brass cleanout plug, with round cast-iron access frame and heavy-duty, secured, scoriated cast-iron cover.

2.5 DROP INLETS

A. Precast Concrete Drop Inlets: Comply with the requirements of the latest edition of the North Carolina Department of Transportation Standard Specifications for Roads and Structures.

B. Cast-in-Place Drop Inlets: Comply with the requirements of the latest edition of the North Carolina Department of Transportation Standard Specifications for Roads and Structures.

C. Drop Inlet Steps, Safety Slabs and Inlet Shaping: Comply with the requirements of the latest edition of the North Carolina Department of Transportation Standard Specifications for Roads and Structures.

D. Drop Inlet Frames and Grates: Comply with the requirements of the latest edition of the North Carolina Department of Transportation Standard Specifications for Roads and Structures.

E. Plastic Drain Basins: Nyloplast or approved equal.

2.6 TRENCH DRAIN SYSTEM

A. Trench drainage system shall be POLYDRAIN (as manufactured by ABT, Inc.) or approved equal.

B. Trench drain grates shall be POLYDRAIN 410, or approved equal. Grates shall be galvanized steel, heelproof grates and shall be reinforced to support heavy duty (H20) loads.

C. Provide all fittings and miscellaneous connections necessary for a complete the trench drainage system per the manufacturer requirements.

2.7 CONCRETE AND REINFORCEMENT

A. Concrete: Conform to the requirements of NCDOT Standard Class B concrete.

B. Reinforcement: Steel conforming to the following:

1. Fabric: ASTM A 185 welded wire fabric, plain.

2. Reinforcement Bars: ASTM A 615, Grade 60, deformed.

2.8 UNDERDRAINS

A. Underdrains and combination underdrains: Conform to the requirements of the latest edition of the NCDOT Standard Specifications for Roads and Structures. for the type of underdrain, unless otherwise indicated.

1. PVC underdrains shall conform to the requirements of ASTM F758, Type PS 28 or ASTM F949.
2. PE corrugated underdrain pipe shall conform to AASHTO M252.

B. Provide a filter fabric “sock” wrapping for all underdrain pipe.

2.9 END WALLS AND END SECTIONS

A. End walls: Conform to the requirements of the latest edition of the NCDOT Standard Specifications for Roads and Structures.

B. End sections: Conform to the requirements of the latest edition of the NCDOT Standard Specifications for Roads and Structures. for the size of pipe indicated.

PART 3 - EXECUTION

3.1 GENERAL

A. Install the storm sewerage system in accordance with the latest edition of the NCDOT Standard Specifications for Roads and Structures.

3.2 PREPARATION OF FOUNDATION FOR BURIED STORM SEWERAGE SYSTEMS

A. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation, throughout the length of the pipe.

B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid, and backfill with clean sand or pea gravel to indicated level.

C. Install pipe bedding conforming to the requirements of the latest edition of the North Carolina Department of Transportation Standard Specifications for Roads and Structures.

3.3 PIPE INSTALLATION

A. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

B. Use proper size increasers, reducers, and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.

C. Extend storm sewerage system piping to connect to building storm drains, of sizes and in locations indicated.

D. Join and install concrete pipe and fittings per NCDOT specifications.

E. Join and install PE pipe and fittings per manufacturer’s recommendations.

F. Join different types of pipe with standard manufactured couplings and fittings intended for that purpose.

3.4 MANHOLES

A. General: Install manholes complete with accessories as indicated. Form continuous concrete or split pipe section channel and benches between inlets and outlet. Set tops of frames and covers flush with finish grade, unless otherwise indicated.

B. Place precast concrete manhole sections as indicated, and install in accordance with ASTM C 891.

C. Construct cast-in-place manholes as indicated.

D. Apply bituminous mastic coating at joints of sections.

3.5 CLEANOUTS

A. Install cleanouts and extension from sewer pipe to cleanout at grade as indicated. Set cleanout frame and cover in concrete block 12 by 12 by 6 inches deep, except where location is in concrete paving. Set top of cleanout flush with finish grade.

3.6 DROP INLETS

A. Construct drop inlets to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.7 INLET SHAPING

A. Construct inlet shaping conforming to NCDOT Standards at all drop inlets and manholes.

3.8 TRENCH DRAIN INSTALLATION

A. Installation of the trench drain shall comply with the manufacturers recommendations.

B. Verify connection to the storm sewer system. Utilize manufacturers standard outlet connections to make connection to the storm sewer system.

C. Install trench drain system starting from the downstream end , working towards the upstream end.

D. Verify proper placement and alignment prior to placement of concrete.

E. Place concrete around suspended trench channel. Do not chute concrete directly against channel walls, as this may cause displacement. Work concrete under channels and vibrate with a finger-type vibrator.

F. Finish surface to be flush with the adjoining surfaces and to allow for positive drainage into the grates.

G. Install grate tops.

3.9 FIELD QUALITY CONTROL

A. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.

1. In large, accessible piping, brushes and brooms may be used for cleaning.

2. Place plugs in ends of uncompleted pipe at end of day or whenever work stops.

3. Flush piping between manholes and drop inlets to remove collected debris. Flush pipes through an approved erosion and sediment control measure.

B. Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.

1. Make inspections after pipe between manholes and manhole locations has been installed and approximately 2 feet of backfill is in place, and again at completion of project.

2. If inspection indicates poor alignment, debris, displaced pipe, infiltration, or other defects correct such defects and reinspect.

END OF SECTION 33 4100