

# PROJECT MANUAL CONSTRUCTION DOCUMENTS

ITB # 26-408 HAMPSTEAD LIBRARY CONSTRUCTION SERVICES

## PENDER COUNTY LIBRARY, HAMPSTEAD BRANCH

15146 US Hwy 17  
Hampstead, NC 28443

October 6, 2025



Sawyer Sherwood & Associate, P.C.  
124 Market Street  
Wilmington, NC 28401

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**INVITATION TO SUBMIT CONSTRUCTION CONTRACT BID**  
**ITB # 26-408 Hampstead Library Construction Services**

- A. Licensed general contractors are invited to submit a single prime, fixed contract sealed bid to Pender County. Sealed proposals will be received until 3:00 p.m. on Thursday, December 18, 2025, at which time they will be publicly opened and read aloud in the boardroom of the Pender County Government Center, 805 S. Walker Street, Burgaw, NC 28425. Submit sealed proposals to the following addresses:  
By Mail: Pender County, Attention: Trisha Newton, PO Box 1578, Burgaw, NC 28425  
By UPS/FedEx/Courier: Pender County, Attention: Trisha Newton, 805 S. Walter Street, Burgaw, NC 28425  
Clearly mark outside of package with general contractor's name, license number, and "ITB # 26-408 Hampstead Library Construction Services". A 5% bid bond is required, and shall be in a separate envelope from the sealed proposal.
- B. **MINORITY BUSINESSES:** Pender County encourages all businesses, including W/WBE, HUB, minority, and women-owned businesses to respond to all Invitations to Bid.
- C. **Project Description:** construction of a new 20,000 square foot library and associated site improvements. Scope of the work is further defined by the project manual and drawings.
- D. A pre-bid conference is scheduled for 2:00 PM on November 20, 2025, in the auditorium at the Pender County Hampstead Annex: 15060 US-17, Hampstead, NC 28443. Pre-bid conference is not mandatory, but bidders are encouraged to attend.
- E. By submitting a bid, Bidders represents that they have visited the site and become familiar with the conditions under which the work is to be performed. The project site is adjacent to the Pender County Hampstead Annex, and is open to the public.
- F. Electronic bid documents, plans, and specifications can be obtained by contacting Scott Spike with Sawyer Sherwood & Associate Architecture at 910 762-0892 or [scott@s2a3.com](mailto:scott@s2a3.com), or by visiting the Architect's website; [s2a3.com/contractors/](http://s2a3.com/contractors/). No partial sets will be issued.
- G. Requests for substitution requests shall be submitted in writing to the Architect by 5:00 PM on December 8, 2025.
- H. Requests for clarification or interpretation of the Bid Documents shall be submitted in writing to the Architect by 5:00 PM on December 11, 2025.
- I. Additional information and addenda will be made available to the public by email or on the Architect's website; [s2a3.com/contractors/](http://s2a3.com/contractors/). The contractor is responsible for ensuring that their contact information (phone & email) is correct and on file with the person designated below.
- J. Bids submitted are done so under a condition of irrevocability for a period of 60 days after the bid date.
- L. The Owner reserves the right to accept or reject any or all bids. In order to be deemed responsive, the bidder must exemplify the skill, judgment, integrity, sufficient financial

resources, and ability necessary to the faithful performance of the construction contract. The bidder's Financial Statements may be requested by the County.

## BID FORM

### Construction Contract Bid Submitted to Pender County for the Pender County Library, Hampstead Branch - ITB # 26-408.

DATE: \_\_\_\_\_ (Bidder to enter date)

SUBMITTED BY: (Bidder to enter name and address)

Company Submitting Bid \_\_\_\_\_

Address \_\_\_\_\_

City, State, Zip \_\_\_\_\_

N.C. General Contractor License No. \_\_\_\_\_

Company representative authorized to submit bids and enter into construction contracts:

Name \_\_\_\_\_ Title \_\_\_\_\_

Signature \_\_\_\_\_

### BASE BID PROPOSAL

Having examined the Place of The Work and all matters referred to in the Instruction to Bidders and the Contract Documents prepared by Sawyer Sherwood & Associate Architecture for the above-mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the Sum of:

Bidder shall write in the amount of the Base Bid here (*does not include Allowances*):

(\$ \_\_\_\_\_)

Total of Allowances: + \$505,000.00

Total Base Bid (*sum of Base Bid and Allowances*)

Bidder shall write in the amount of the Total Base Bid here:

\_\_\_\_\_ dollars

(\$ \_\_\_\_\_), in lawful money of the United States of America.

We have included the required security Bid Bond as required by the Instruction to Bidders.

**CONTRACT TIME**

If awarded the construction contract for the project, we will complete the Work in 420 calendar days from Notice to Proceed.

**ALLOWANCES**

Total Base Bid includes all allowances listed below. Allowances will be used as specified in section 01 2100 Allowances. Unused amounts will be credited to the Owner by Change Order at the end of the project.

Owner Contingency Allowance:       \$475,000.00

Emergency Radio Communication Enhancement System Contingency Allowance:  
\$30,000.00

**UNIT PRICES**

The following are Unit Prices for specific portions of the Work as specified. Unit prices will be used as specified in section 01 2200 Unit Prices.

UNIT PRICE #1       Mass Rock removal and disposal off-site.

Dollars per cubic yard\_\_\_\_\_

UNIT PRICE #2       Trench Rock removal and disposal off-site.

Dollars per cubic yard\_\_\_\_\_

UNIT PRICE #3       Unsuitable soils removal and disposal on-site.

Dollars per cubic yard\_\_\_\_\_

UNIT PRICE #4       Unsuitable soils removal and disposal off-site.

Dollars per cubic yard\_\_\_\_\_

UNIT PRICE #5       Replacement of removed rock or unsuitable soils with on-site  
suitable soil in-place.

Dollars per cubic yard\_\_\_\_\_

UNIT PRICE #6       Replacement of removed rock or unsuitable soils with off-site  
suitable soil in-place.

Dollars per cubic yard\_\_\_\_\_

UNIT PRICE #7       Replacement of removed rock or unsuitable soils with Aggregate  
Base Course in-place.

Dollars per cubic yard\_\_\_\_\_

UNIT PRICE #8      Replacement of removed rock or unsuitable soils with No. 57  
washed stone in-place.

Dollars per cubic yard\_\_\_\_\_

UNIT PRICE #9      Woven Geo-Textile Fabric in-place.

Dollars per square yard\_\_\_\_\_

UNIT PRICE #10      Biaxial Geo-Grid in-place.

Dollars per square yard\_\_\_\_\_

### **ADDENDA**

The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Bid Sum.

Addendum #\_\_\_\_\_ Dated\_\_\_\_\_

Addendum #\_\_\_\_\_ Dated\_\_\_\_\_

Addendum #\_\_\_\_\_ Dated\_\_\_\_\_

Addendum #\_\_\_\_\_ Dated\_\_\_\_\_

### **SUBCONTRACTOR LIST**

The following subcontractors will be utilized to complete the project:

#### Plumbing

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

Address\_\_\_\_\_

N.C. License\_\_\_\_\_

#### Mechanical

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

Address\_\_\_\_\_

N.C. License\_\_\_\_\_

#### Electrical

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

Address\_\_\_\_\_

N.C. License\_\_\_\_\_

Fire Sprinkler

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

Address\_\_\_\_\_

N.C. License\_\_\_\_\_

**END OF BID FORM**

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

## Instructions to Bidders

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

Pender County Library, Hampstead Branch  
15146 US Hwy 17  
Hampstead, NC 28443  
Branch Library

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

Pender County  
805 S. Walker Street  
Burgaw, NC 28425

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

Sawyer Sherwood & Associate, P.C.  
124 Market Street  
Wilmington, NC 28401

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### ADDITIONS AND DELETIONS:

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

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

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

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

## ARTICLE 1 DEFINITIONS

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

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

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

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

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

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

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

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

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

## ARTICLE 2 BIDDER'S REPRESENTATIONS

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

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

## ARTICLE 3 BIDDING DOCUMENTS

### § 3.1 Distribution

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

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

Refer to Invitation to Bid

§ 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 Invitation to Bid

**§ 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.)*

§ 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.)*

5% of the bid amount including all alternate bids and in the form stipulated in the Instructions to Bidders

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

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

Project is located.

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

### **§ 4.3 Submission of Bids**

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

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

Refer to Invitation to Bid

**§ 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.)*

Bid security to be returned.

## **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. A Bid not accompanied by a required bid security or by other data required by the Bidding Documents, or a Bid which is in any way incomplete or irregular is subject to rejection.

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

§ 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

### § 6.3 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.

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

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

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

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

and delivered in accordance with this Section 7.2.1.

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

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

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

## **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.)*
- .2** 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.)*
- .3** Drawings
- .4** Specifications
- .5** Addenda:

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

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

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 16:55:02 EST on 11/04/2025.

## Changes to original AIA text

### PAGE 4

§ 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.~~

### PAGE 5

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

### PAGE 6

#### ~~§ 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.~~

§ 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.~~

### PAGE 7

2. AIA Document A101™-2017, Exhibit A, Insurance and Bonds A201™-2017, General Conditions of the Contract for Construction, unless otherwise stated below.

~~.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.)*

~~.4~~ Building Information Modeling Exhibit, if completed:

~~.5~~

~~.3~~ Drawings

~~.64~~ Specifications

~~.75~~ Addenda:

~~.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:

☐ Supplementary and other Conditions of the Contract:

~~.9~~ Other documents listed below:

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

## **Variable Information**

### **PAGE 1**

Pender County Library, Hampstead Branch

15146 US Hwy 17  
Hampstead, NC 28443

Branch Library

Pender County

805 S. Walker Street

Burgaw, NC 28425

Sawyer Sherwood & Associate, P.C.

124 Market Street

Wilmington, NC 28401

### **PAGE 2**

Refer to Invitation to Bid

PAGE 3

Refer to Invitation to Bid

PAGE 4

5% of the bid amount including all alternate bids and in the form stipulated in the Instructions to Bidders

PAGE 5


Refer to Invitation to Bid

Bid security to be returned.

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

**AIA® Document D401™ – 2003**

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 16:55:02 EST on 11/04/2025 under Order No. 20250119564 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A701™ - 2018, Instructions to Bidders, other than those additions and deletions shown in the associated Additions and Deletions Report.

  
(Signed)

Jenny Williams, Architect  
(Title)

11/4/25  
(Dated)

 **AIA<sup>®</sup> Document A310<sup>™</sup> – 2010****Bid Bond****CONTRACTOR:***(Name, legal status and address)***SURETY:***(Name, legal status and principal place of business)***OWNER:***(Name, legal status and address)*

Pender County  
805 S. Walker Street  
Burgaw, NC 28425

**BOND AMOUNT: \$****PROJECT:***(Name, location or address, and Project number, if any)*

Pender County Library, Hampstead Branch  
15146 US Hwy 17  
Hampstead, NC 28443

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.

**ADDITIONS AND DELETIONS:**

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

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

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

Signed and sealed this day of , Two Thousand Twenty-Five

CONTRACTOR AS PRINCIPAL *(Signature)*

*(Printed name and title)*

*(Witness)*

SURETY *(Signature)*

*(Printed name and title)*

*(Witness)*

# **Additions and Deletions Report for** **AIA® Document A310™ – 2010**

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

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 08:06:11 EST on 11/05/2025.

## **Changes to original AIA text**

### **PAGE 2**

Signed and sealed this—\_day of—\_, Two Thousand Twenty-Five

## **Variable Information**

### **PAGE 1**

Pender County

805 S. Walker Street  
Burgaw, NC 28425

Pender County Library, Hampstead Branch

15146 US Hwy 17  
Hampstead, NC 28443

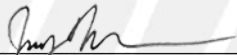
### **PAGE 2**

Signed and sealed this—\_day of—\_, Two Thousand Twenty-Five

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

**AIA® Document D401™ – 2003**

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 08:06:11 EST on 11/05/2025 under Order No. 20250119564 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A310™ - 2010, Bid Bond, other than those additions and deletions shown in the associated Additions and Deletions Report.

  
(Signed)

Jenny Williams, Architect  
(Title)

11/5/25  
(Dated)

# 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 Two Thousand   
(In words, indicate day, month and year.)

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

Pender County  
805 S. Walker Street  
Burgaw, NC 28425

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

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

Pender County Library, Hampstead Branch  
15146 US Hwy 17  
Hampstead, NC 28443  
Branch Library

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

Sawyer Sherwood & Associate, P.C.  
124 Market Street  
Wilmington, NC 28401

The Owner and Contractor agree as follows.

### **ADDITIONS AND DELETIONS:**

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

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

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.

**ELECTRONIC COPYING** of any portion of this AIA® Document to another electronic file is prohibited and constitutes a violation of copyright laws as set forth in the footer of this document.

## TABLE OF ARTICLES

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

## EXHIBIT A INSURANCE AND BONDS

### 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 Three Hundred Ninety ( 390 ) calendar days from the date of commencement of the Work.
- ☐ By the following 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 zero Dollars and Zero Cents (\$ 0.00 ), subject to additions and deductions as provided in the Contract Documents.

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

Item	Price
Owner Contingency Allowance	\$475,000.00
Emergency Radio Communication	\$30,000.00
Enhancement System Contingency	

**§ 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)
Unit Price #1: Mass Rock removal and disposal off-site	Dollars per cubic yard	
Unit Price #2: Trench Rock removal and disposal off-site	Dollars per cubic yard	
Unit Price #3: Unsuitable soils removal and disposal on-site	Dollars per cubic yard	
Unit Price #4: Unsuitable soils removal and disposal off-site	Dollars per cubic yard	
Unit Price #5: Replacement of removed rock or unsuitable soils with on-site suitable soil in-place	Dollars per cubic yard	
Unit Price #6: Replacement of removed rock or unsuitable soils with off-site suitable soil in-place	Dollars per cubic yard	
Unit Price #7: Replacement of removed rock or unsuitable soils with Aggregate Base Course in-place	Dollars per cubic yard	
Unit Price #8: Replacement of removed rock or unsuitable soils with No. 57 washed stone in-place	Dollars per cubic yard	
Unit Price #9: Woven Geo-Textile Fabric in-place	Dollars per square yard	
Unit Price #10: Biaxial Geo-Grid in-place	Dollars per square yard	

**§ 4.5** Liquidated damages, if any:

*(Insert terms and conditions for liquidated damages, if any.)*

The Work is to be completed within Four Hundred Twenty (420) calendar days from Notice to Proceed. After that time, liquidated damages will be one thousand (\$1,000) per calendar day.

**§ 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:

ending on the 25th day of the month

**§ 5.1.3** Provided that an Application for Payment is received by the Architect not later than the Twenty-Fifth day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the Twenty-Fifth day of the following 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 Thirty ( 30 ) 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%

**§ 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% retainage will apply to the billed amounts until project reaches 50% completion. Overall retainage will be 2.5% of the total contract amount throughout the project.

**§ 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, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere 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 a building information modeling exhibit, if completed, or as otherwise set forth below:

*(If other than in accordance with a building information modeling exhibit, 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

.5 Drawings

.6 Specifications

.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:

☒ 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.)*

Bid Form & Bid Bond submitted by contractor

Bid Advertisement

Instructions to Bidders

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

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

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



# Additions and Deletions Report for AIA® Document A101® – 2017

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

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## Changes to original AIA text

### PAGE 3

~~§ 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:~~

#### § 4.2 Alternates

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

~~§ 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
<u>Owner Contingency Allowance</u>	<u>\$475,000.00</u>
<u>Emergency Radio Communication</u>	<u>\$30,000.00</u>
<u>Enhancement System Contingency</u>	

Item	Units and Limitations	Price per Unit (\$0.00)
<u>Unit Price #1: Mass Rock removal and disposal off-site</u>	<u>Dollars per cubic yard</u>	
<u>Unit Price #2: Trench Rock removal and disposal off-site</u>	<u>Dollars per cubic yard</u>	
<u>Unit Price #3: Unsuitable soils removal and disposal on-site</u>	<u>Dollars per cubic yard</u>	
<u>Unit Price #4: Unsuitable soils removal and disposal off-site</u>	<u>Dollars per cubic yard</u>	
<u>Unit Price #5: Replacement of removed rock or unsuitable soils with on-site suitable soil in-place</u>	<u>Dollars per cubic yard</u>	
<u>Unit Price #6: Replacement of removed rock or unsuitable soils with off-site suitable soil in-place</u>	<u>Dollars per cubic yard</u>	
<u>Unit Price #7: Replacement of removed rock or unsuitable soils with Aggregate Base Course in-place</u>	<u>Dollars per cubic yard</u>	
<u>Unit Price #8: Replacement of removed rock or unsuitable soils with No. 57 washed stone in-place</u>	<u>Dollars per cubic yard</u>	
<u>Unit Price #9: Woven Geo-Textile Fabric in-place</u>	<u>Dollars per square yard</u>	

Unit Price #10: Biaxial Geo-Grid in-  
place

Dollars per square yard

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- ~~4 Building information modeling exhibit, dated as indicated below:  
(Insert the date of the building information modeling exhibit incorporated into this Agreement.)~~

**Variable Information**

**PAGE 1**

**AGREEMENT** made as of the First day of January in the year Two Thousand Twenty-Six  
(In words, indicate day, month and year.)

Pender County

805 S. Walker Street  
Burgaw, NC 28425

Pender County Library, Hampstead Branch

15146 US Hwy 17  
Hampstead, NC 28443

Branch Library

Sawyer Sherwood & Associate, P.C.

124 Market Street  
Wilmington, NC 28401

**PAGE 2**

- ☐ 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.)
- ☒ Not later than Three Hundred Ninety ( 390 ) calendar days from the date of commencement of the Work.
- ☐ By the following date:

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**§ 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 zero Dollars and Zero Cents ( \$ 0.00 ), subject to additions and deductions as provided in the Contract Documents.

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The Work is to be completed within Four Hundred Twenty (420) calendar days from Notice to Proceed. After that time, liquidated damages will be one thousand (\$1,000) per calendar day.

ending on the 25th day of the month

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the Twenty-Fifth day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the Twenty-Fifth day of the following 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 Thirty ( 30 ) days after the Architect receives the Application for Payment.

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

**PAGE 5**

5%

5% retainage will apply to the billed amounts until project reaches 50% completion. Overall retainage will be 2.5% of the total contract amount throughout the project.

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☐ Arbitration pursuant to Section 15.4 of AIA Document A201–2017

☒ Litigation in a court of competent jurisdiction

☐ Other (*Specify*)

**PAGE 7**

☒ Supplementary and other Conditions of the Contract:

Bid Form & Bid Bond submitted by contractor

Bid Advertisement

Instructions to Bidders

## ***General Conditions of the Contract for Construction***

**for the following PROJECT:**

*(Name and location or address)*

Pender County Library, Hampstead Branch  
15146 US Hwy 17  
Hampstead, North Carolina 28443

**THE OWNER:**

*(Name, legal status and address)*

Pender County  
805 S. Walker Street  
Burgaw, NC 28425

**THE ARCHITECT:**

*(Name, legal status and address)*

Sawyer Sherwood & Associate, P.C.  
124 Market Street  
Wilmington, NC 28401

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- 11 INSURANCE AND BONDS**
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- 13 MISCELLANEOUS PROVISIONS**

**ADDITIONS AND DELETIONS:**

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

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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 requirements.

#### **§ 1.1.2 THE CONTRACT**

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

#### **§ 1.1.3 THE WORK**

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

#### **§ 1.1.4 THE PROJECT**

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

#### **§ 1.1.5 THE DRAWINGS**

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

#### **§ 1.1.6 THE SPECIFICATIONS**

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

#### **§ 1.1.7 INSTRUMENTS OF SERVICE**

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

#### **§ 1.1.8 INITIAL DECISION MAKER**

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

### **§ 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS**

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

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

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

### **§ 1.3 CAPITALIZATION**

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

### **§ 1.4 INTERPRETATION**

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

### **§ 1.5 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE**

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

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

### **§ 1.6 TRANSMISSION OF DATA IN DIGITAL FORM**

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

## **ARTICLE 2 OWNER**

### **§ 2.1 GENERAL**

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

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

### **§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER**

**§ 2.2.1** Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner’s obligations under the Contract. Thereafter, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner’s ability to make payment when due. The Owner shall furnish such evidence as a condition precedent to commencement or continuation of the Work or the portion of the Work affected by a material change. After the Owner furnishes the evidence, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

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

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

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

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

### **§ 2.3 OWNER'S RIGHT TO STOP THE WORK**

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

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

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

## **ARTICLE 3 CONTRACTOR**

### **§ 3.1 GENERAL**

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

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

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

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

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

**§ 3.2.2** Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

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

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

### **§ 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES**

**§ 3.3.1** The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

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

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

### **§ 3.4 LABOR AND MATERIALS**

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

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

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

### **§ 3.5 WARRANTY**

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

### **§ 3.6 TAXES**

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

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

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

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

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

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

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

### **§ 3.8 ALLOWANCES**

**§ 3.8.1** The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct,

but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

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

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

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

**§ 3.9 SUPERINTENDENT**

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

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

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

**§ 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES**

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

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

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

**§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE**

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

### **§ 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES**

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

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

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

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

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

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

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

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

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

**§ 3.12.10** The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled

to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

### **§ 3.13 USE OF SITE**

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

### **§ 3.14 CUTTING AND PATCHING**

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

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

### **§ 3.15 CLEANING UP**

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

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

### **§ 3.16 ACCESS TO WORK**

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

### **§ 3.17 ROYALTIES, PATENTS AND COPYRIGHTS**

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

### **§ 3.18 INDEMNIFICATION**

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

3.18.

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

## **ARTICLE 4 ARCHITECT**

### **§ 4.1 GENERAL**

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

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

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

### **§ 4.2 ADMINISTRATION OF THE CONTRACT**

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

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

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

### **§ 4.2.4 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION**

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

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

**§ 4.2.6** The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed.

However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

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

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

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

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

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

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

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

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

## **ARTICLE 5 SUBCONTRACTORS**

### **§ 5.1 DEFINITIONS**

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

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

## **§ 5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK**

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

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

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

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

## **§ 5.3 SUBCONTRACTUAL RELATIONS**

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

## **§ 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS**

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

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

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

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

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

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

### **§ 6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS**

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

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

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

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

### **§ 6.2 MUTUAL RESPONSIBILITY**

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

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

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

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

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

### **§ 6.3 OWNER'S RIGHT TO CLEAN UP**

If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the

Owner may clean up and the Architect will allocate the cost among those responsible.

## **ARTICLE 7 CHANGES IN THE WORK**

### **§ 7.1 GENERAL**

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

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

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

### **§ 7.2 CHANGE ORDERS**

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

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

### **§ 7.3 CONSTRUCTION CHANGE DIRECTIVES**

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

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

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

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

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

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

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

**§ 7.3.7** If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit 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 7.3.7 shall be limited to the following:

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

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

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

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

## **§ 7.4 MINOR CHANGES IN THE WORK**

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

## **ARTICLE 8 TIME**

### **§ 8.1 DEFINITIONS**

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

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

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

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

### **§ 8.2 PROGRESS AND COMPLETION**

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

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

furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

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

### **§ 8.3 DELAYS AND EXTENSIONS OF TIME**

**§ 8.3.1** If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control; or by delay authorized by the Owner pending mediation and arbitration; or by other causes that the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

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

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

## **ARTICLE 9 PAYMENTS AND COMPLETION**

### **§ 9.1 CONTRACT SUM**

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

### **§ 9.2 SCHEDULE OF VALUES**

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

### **§ 9.3 APPLICATIONS FOR PAYMENT**

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

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

**§ 9.3.3** The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the

Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

#### **§ 9.4 CERTIFICATES FOR PAYMENT**

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

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

#### **§ 9.5 DECISIONS TO WITHHOLD CERTIFICATION**

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

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

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

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

## **§ 9.6 PROGRESS PAYMENTS**

**§ 9.6.1** After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect. Payment will be made within 30 days after receipt of an approved invoice. The value of stored materials shall not exceed 20% of the gross project invoices.

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

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

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

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

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

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

## **§ 9.7 FAILURE OF PAYMENT**

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

## **§ 9.8 SUBSTANTIAL COMPLETION**

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

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

**§ 9.8.3** Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so

that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

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

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

## **§ 9.9 PARTIAL OCCUPANCY OR USE**

**§ 9.9.1** The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

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

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

## **§ 9.10 FINAL COMPLETION AND FINAL PAYMENT**

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

**§ 9.10.2** Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a

bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

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

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

- .1 liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents; or
- .3 terms of special warranties required by the Contract Documents.

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

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

### **§ 10.1 SAFETY PRECAUTIONS AND PROGRAMS**

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

### **§ 10.2 SAFETY OF PERSONS AND PROPERTY**

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

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

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

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

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

**§ 10.2.5** The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable,

and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

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

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

**§ 10.2.8 INJURY OR DAMAGE TO PERSON OR PROPERTY**

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

**§ 10.3 HAZARDOUS MATERIALS**

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

**§ 10.3.2** Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up.

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

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

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

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

#### **§ 10.4 EMERGENCIES**

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

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

#### **§ 11.1 CONTRACTOR'S LIABILITY INSURANCE**

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

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

**§ 11.1.2** The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

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

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

## **§ 11.2 OWNER'S LIABILITY INSURANCE**

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

## **§ 11.3 PROPERTY INSURANCE**

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

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

**§ 11.3.1.2** If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance that will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

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

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

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

## **§ 11.3.2 BOILER AND MACHINERY INSURANCE**

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

## **§ 11.3.3 LOSS OF USE INSURANCE**

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

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

**§ 11.3.5** If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

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

#### **§ 11.3.7 WAIVERS OF SUBROGATION**

The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

**§ 11.3.8** A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

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

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

#### **§ 11.4 PERFORMANCE BOND AND PAYMENT BOND**

**§ 11.4.1** The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

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

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

### **§ 12.1 UNCOVERING OF WORK**

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

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

### **§ 12.2 CORRECTION OF WORK**

#### **§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION**

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

#### **§ 12.2.2 AFTER SUBSTANTIAL COMPLETION**

**§ 12.2.2.1** In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

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

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

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

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

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

### **§ 12.3 ACCEPTANCE OF NONCONFORMING WORK**

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

## **ARTICLE 13 MISCELLANEOUS PROVISIONS**

### **§ 13.1 GOVERNING LAW**

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

### **§ 13.2 SUCCESSORS AND ASSIGNS**

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

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

### **§ 13.3 WRITTEN NOTICE**

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

### **§ 13.4 RIGHTS AND REMEDIES**

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

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

### **§ 13.5 TESTS AND INSPECTIONS**

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

**§ 13.5.2** If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

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

shall be at the Contractor's expense.

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

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

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

### **§ 13.6 INTEREST**

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may 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.

### **§ 13.7 TIME LIMITS ON CLAIMS**

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

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

### **§ 14.1 TERMINATION BY THE CONTRACTOR**

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

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

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

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

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

## **§ 14.2 TERMINATION BY THE OWNER FOR CAUSE**

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

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

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

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

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

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

## **§ 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE**

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

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

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

## **§ 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE**

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

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

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

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

## ARTICLE 15 CLAIMS AND DISPUTES

### § 15.1 CLAIMS

#### § 15.1.1 DEFINITION

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim.

#### § 15.1.2 NOTICE OF CLAIMS

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

#### § 15.1.3 CONTINUING CONTRACT PERFORMANCE

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

#### § 15.1.4 CLAIMS FOR ADDITIONAL COST

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

#### § 15.1.5 CLAIMS FOR ADDITIONAL TIME

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

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

- .1 Adverse weather conditions shall include those days on which precipitation is 0.10 of an inch, or greater, or any day the temperature fails to exceed 32 degrees F. The time for performance of this contract, as stated in the Contract Documents, includes an allowance for calendar days which may not be available for construction out-of-doors. The number of calendar days per month listed below shall be considered reasonably anticipated adverse weather days, and planned for in the construction schedule. To make a claim for a time extension, the Contractor shall substantiate to the satisfaction of the Architect and Owner that the number of adverse weather days exceeded the days listed in the table below, and that such adverse weather days actually delayed work on the critical path. Time extension requests based on adverse weather conditions shall be evaluated using data from the National Weather Service Station at Wilmington International Airport.

#### Reasonably Anticipated Adverse Weather Days:

January: 7 days	July: 10 days
February: 6 days	August: 9 days
March: 7 days	September: 7 days
April: 5 days	October: 4 days
May: 6 days	November: 5 days
June: 7 days	December: 6 days

#### § 15.1.6 CLAIMS FOR CONSEQUENTIAL DAMAGES

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

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

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.6 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

## **§ 15.2 INITIAL DECISION**

**§ 15.2.1** Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

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

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

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

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

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

**§ 15.2.6.1** Either party may, within 30 days from the date of an initial decision, demand in writing that the other party file for mediation within 60 days of the initial decision. If such a demand is made and the party receiving the demand fails to file for mediation within the time required, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

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

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

### **§ 15.3 MEDIATION**

**§ 15.3.1** Claims, disputes, or other matters in controversy arising out of or related to the Contract except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.6 shall be subject to mediation as a condition precedent to binding dispute resolution.

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

### **§ 15.4 ARBITRATION**

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

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

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

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

### **§ 15.4.4 CONSOLIDATION OR JOINDER**

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

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

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

Contractor under this Agreement.

FOR AIA R D

# Additions and Deletions Report for AIA® Document A201® – 2007

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

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 16:36:56 EST on 11/04/2025.

## Changes to original AIA text

### PAGE 26

§ 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. Payment will be made within 30 days after receipt of an approved invoice. The value of stored materials shall not exceed 20% of the gross project invoices.

### PAGE 37

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

.1 Adverse weather conditions shall include those days on which precipitation is 0.10 of an inch, or greater, or any day the temperature fails to exceed 32 degrees F. The time for performance of this contract, as stated in the Contract Documents, includes an allowance for calendar days which may not be available for construction out-of-doors. The number of calendar days per month listed below shall be considered reasonably anticipated adverse weather days, and planned for in the construction schedule. To make a claim for a time extension, the Contractor shall substantiate to the satisfaction of the Architect and Owner that the number of adverse weather days exceeded the days listed in the table below, and that such adverse weather days actually delayed work on the critical path. Time extension requests based on adverse weather conditions shall be evaluated using data from the National Weather Service Station at Wilmington International Airport.

#### Reasonably Anticipated Adverse Weather Days:

January: 7 days  
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May: 6 days  
June: 7 days

July: 10 days  
August: 9 days  
September: 7 days  
October: 4 days  
November: 5 days  
December: 6 days

## Variable Information

### PAGE 1

#### **for the following PROJECT:**

*(Name and location or address)*

Pender County Library, Hampstead Branch  
15146 US Hwy 17  
Hampstead, North Carolina 28443

**THE OWNER:**

*(Name, legal status and address)*

Pender County

805 S. Walker Street

Burgaw, NC 28425

**THE ARCHITECT:**

*(Name, legal status and address)*

Sawyer Sherwood & Associate, P.C.

124 Market Street

Wilmington, NC 28401

REBAR

# AIA® Document A312® – 2010

## Payment Bond

**CONTRACTOR:**

(Name, legal status and address)

**SURETY:**

(Name, legal status and principal place of business)

**OWNER:**

(Name, legal status and address)

Pender County  
805 S. Walker Street  
Burgaw, NC 28425

**CONSTRUCTION CONTRACT**

Date: .

Amount: \$

Description:

(Name and location)

Pender County Library, Hampstead Branch  
15146 US Hwy 17 Hampstead, NC 28443

**BOND**

Date:

(Not earlier than Construction Contract Date)

Amount: \$

Modifications to this Bond:

Company: (Corporate seal)

Company: (Corporate seal)

CONTRACTOR AS PRINCIPAL

(Signature)

SURETY (Signature)

(Printed name and title)

(Printed name and title)

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

(FOR INFORMATION ONLY — Name, address and telephone)

**AGENT or BROKER:**

**OWNER'S REPRESENTATIVE:**

(Architect, Engineer or other party:)

**ADDITIONS AND DELETIONS:**

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

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

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

**ELECTRONIC COPYING** of any portion of this AIA® Document to another electronic file is prohibited and constitutes a violation of copyright laws as set forth in the footer of this document.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## **§ 16 Definitions**

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

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

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

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

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

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

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

§ 18 Modifications to this bond are as follows:

*(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)*

THE  
AIA  
BOND

# **Additions and Deletions Report for** **AIA® Document A312® – 2010**

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

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## **Changes to original AIA text**

**There are no edits to the original text**

## **Variable Information**

**PAGE 1**

### **OWNER:**

*(Name, legal status and address)*

Pender County  
805 S. Walker Street  
Burgaw, NC 28425

### **CONSTRUCTION CONTRACT**

Date: \_

Amount: \$

Description:

*(Name and location)*

Pender County Library, Hampstead Branch  
15146 US Hwy 17 Hampstead, NC 28443

# AIA® Document A312® – 2010

## Performance Bond

**CONTRACTOR:**

(Name, legal status and address)

**SURETY:**

(Name, legal status and principal place of business)

**OWNER:**

(Name, legal status and address)

Pender County  
805 S. Walker Street  
Burgaw, NC 28425

**CONSTRUCTION CONTRACT**

Date: .

Amount: \$

Description:

(Name and location)

Pender County Library, Hampstead Branch  
15146 US Hwy 17 Hampstead, NC 28443

**BOND**

Date:

(Not earlier than Construction Contract Date)

Amount: \$

Modifications to this Bond:

Company: (Corporate seal)

Company: (Corporate seal)

\_\_\_\_\_  
**CONTRACTOR AS PRINCIPAL**

(Signature)

\_\_\_\_\_  
**SURETY** (Signature)

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

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

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

(FOR INFORMATION ONLY — Name, address and telephone)

**AGENT or BROKER:**

**OWNER'S REPRESENTATIVE:**

(Architect, Engineer or other party:)

**ADDITIONS AND DELETIONS:**

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

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

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

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**§ 1** The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

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

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

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

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

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

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

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

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

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

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

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

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

- .1** the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;
- .2** additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and

- .3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

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

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

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

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

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

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

#### **§ 14 Definitions**

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

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

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

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

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

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

**§ 16** Modifications to this bond are as follows:

*(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)*

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Amount: \$

Description:

*(Name and location)*

Pender County Library, Hampstead Branch

15146 US Hwy 17 Hampstead, NC 28443

# Hampstead Library

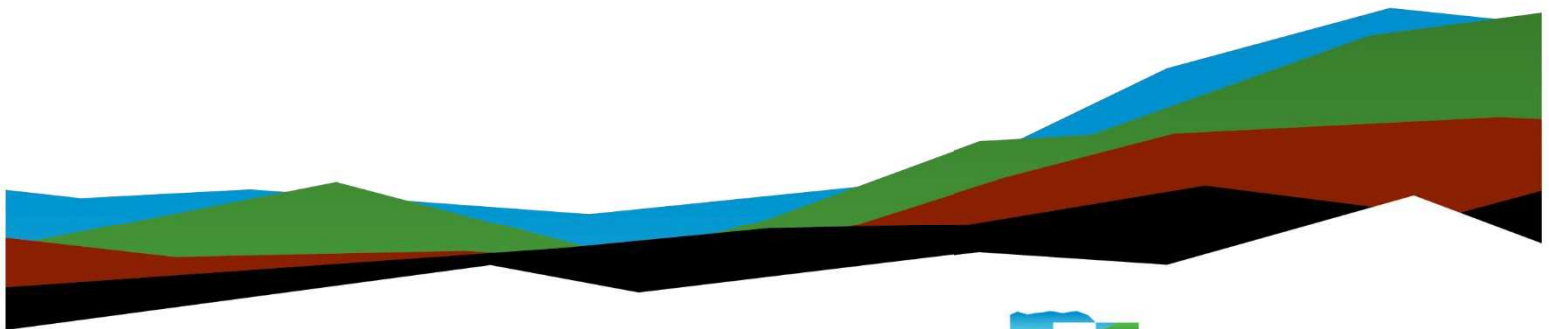
## Geotechnical Engineering Report

15060 US-17, Hampstead, North Carolina

December 13, 2024 | Terracon Project No. K6245099

### Prepared for:

Pender County  
805 S Walker St  
Burgaw, NC 28425



Nationwide  
Terracon.com

- Facilities
- Environmental
- Geotechnical
- Materials



2108 Capital Drive  
Wilmington, North Carolina 28405  
P (910) 478-9915  
North Carolina Registered Firm: F-0869  
**Terracon.com**

December 13, 2024

Pender County  
805 S Walker St  
Burgaw, NC 28425

Attn: Dario Ramirez-Duenas – Project Manager  
P: (910) 352-3108  
E: dramirezduenas@pendercountync.gov

Re: Geotechnical Engineering Report  
Hampstead Library  
15060 US-17  
Hampstead, North Carolina  
Terracon Project No. K6245099

Dear Mr. Ramirez-Duenas:

We have completed the scope of Geotechnical Engineering services for the above referenced project in general accordance with Terracon Proposal No. PK6245099 dated October 24, 2024. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations, floor slabs, pavements, and Stormwater Control Measures (SCMs) for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,

**Terracon**



12/13/2024

Justin L. DeNicola, P.E.  
Office Manager  
Registered, NC 046129

Tom Schipporeit, P.E., BC.GE  
Senior Geotechnical Engineer



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- Exploration and Testing Procedures
- Photography Log
- Site Location and Exploration Plans
- Exploration and Laboratory Results
- Supporting Information

**Note:** This report was originally delivered in a web-based format. **Blue Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the  logo will bring you back to this page. For more interactive features, please view your project online at [client.terracon.com](http://client.terracon.com). Refer to each individual Attachment for a listing of contents.

## Introduction

This report presents the results of our subsurface exploration and Geotechnical Engineering services performed for the proposed library to be located at of 15060 US-17 in Hampstead, North Carolina. The purpose of these services was to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Seismic site classification
- Site preparation and earthwork
- Demolition considerations
- Foundation design and construction
- Floor slab design and construction
- Pavement design and construction
- Stormwater management considerations

The geotechnical engineering Scope of Services for this project included the advancement of electronic Cone Penetrometer Test (CPT) soundings and hand auger borings, laboratory testing, engineering analysis, and preparation of this report.

Drawings showing the site and exploration locations are shown on the [Site Location](#) and [Exploration Plan](#), respectively. The results of the laboratory testing performed on soil samples obtained from the site during our field exploration are included on the exploration logs and as separate graphs in the [Exploration and Laboratory Results](#) section.

## Project Description

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
<b>Information Provided</b>	<p>Project information was obtained via email correspondence on October 14, 2024. The email contained an RFP with the following exhibits:</p> <ul style="list-style-type: none"> <li>■ <i>Exhibit A - Geotechnical Checklist prepared by CLH Design</i></li> <li>■ <i>Exhibit B - Hampstead Library Soil Boring Exhibit prepared by CLH Design</i></li> <li>■ <i>Exhibit C - Architectural Site Plan prepared by Sawyer Sherwood &amp; Associates Architecture</i></li> </ul> <p>Additional project information was obtained during a conference call attended by Pender County, Sawyer Sherwood &amp; Associates Architecture, and Terracon.</p>
<b>Project Description</b>	Plans for the project include the construction of new library building with associated parking and drives and a stormwater control measure (SCM).
<b>Proposed Structure</b>	Single-story, approximately 68,400 square foot library
<b>Building Construction</b>	We understand the building will be metal or wood framed with concrete slab on grade construction.
<b>Finished Floor Elevation</b>	Assumed to be at or within 2 feet of existing grades.
<b>Maximum Loads</b>	<p>Anticipated structural loads for columns and walls were provided by Woods Engineering.</p> <ul style="list-style-type: none"> <li>■ Columns: 50 kips</li> <li>■ Walls: 2 kips per linear foot (klf)</li> <li>■ Slabs: 100 pounds per square foot (psf)</li> </ul>
<b>Grading/Slopes</b>	Less than 2 feet of cut and fill is anticipated to develop final grade, excluding remedial grading requirements.
<b>Below-Grade Structures</b>	None
<b>Free-Standing Retaining Walls</b>	None



Item	Description
Pavements	<p>We understand both rigid (concrete) and flexible (asphalt) pavement sections will be constructed.</p> <p>Assumed pavement traffic is as follows:</p> <ul style="list-style-type: none"><li>■ Autos/light trucks: 400 vehicles per day</li><li>■ Light delivery and trash collection vehicles: 5 vehicles per week</li><li>■ Tractor-trailer trucks: &lt;1 vehicle per week</li></ul> <p>The pavement design period is 20 years.</p>

Terracon should be notified if any of the above information is inconsistent with the planned construction, especially the grading and structural loading information, as modifications to our recommendations may be necessary.

## Site Conditions

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project is located at 15060 US-17 in Hampstead, North Carolina. See <a href="#">Site Location</a>
Existing Improvements	The site is currently used as a baseball and softball field. An existing water line runs along the north and east end of the site.
Current Ground Cover	Grass
Existing Topography	A majority of the site is relatively flat at an elevation of 56 feet MSL based on the provided survey.

We also collected photographs at the time of our field exploration program. Representative photos are provided in our [Photography Log](#).

## Geotechnical Characterization

### Geologic Setting

The project site is located within the Atlantic Coastal Plain physiographic province. Bedrock of the Late Mesozoic age is present at depths of greater than 1,000 ft, and is overlain by Lower and Upper Cretaceous, Tertiary, Pleistocene and Recent Sediments.

The Coastal Plain soils consist mainly of marine sediments that were deposited during successive periods of fluctuating sea level and moving shoreline. The soils include sands, silts, and clays with irregular deposits of shells, which are typical of those laid down in a shallow sloping sea bottom. Recent alluvial sands, silts, and clays are typically present near rivers and creeks.

According to USGS Mineral Resources On-Line Spatial Data based on the 1998 digital equivalent of the 1985 Geologic Map of North Carolina, the Castle Hayne Formation underlies this site. The Castle Hayne Formation varies lithologically, consisting of shell, marl, sand, and limestone.

## Soil Profile

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of the site. Conditions observed at each exploration point are indicated on the individual logs. The individual logs can be found in the [Exploration and Laboratory Results](#) and the GeoModel can be found in the [Figures](#) attachment of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel. Surficial materials (topsoil, asphalt, etc.) are not included in the GeoModel.

Model Layer	Layer Name	General Description
1	Existing Fill	Poorly graded sand
2	Sand	Loose to medium dense sand
3	Clay	Soft to medium stiff clay
4	Underlying Sand	Medium dense to dense sand
5	Castle Hayne Formation	Indicated by CPT refusal

Some of the CPT soundings and hand auger borings encountered 2 to 4 inches of topsoil just below the ground surface, with an average depth of about 4 inches.

## Groundwater Conditions

Groundwater was measured at 7.3 to 9.3 feet below existing grades during our field exploration.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings/soundings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the exploration logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

A soil scientist licensed in the state of North Carolina was contracted to evaluate the seasonal-high water table and perform infiltration testing at locations SCM-01 and SCM-02. The SHWT and infiltration results are presented in the attached **Stormwater Soil Evaluations Report** within [Supporting Information](#).

## Seismic Considerations

### Seismic Site Classification

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC). Based on the soil properties observed at the site and as described on the exploration logs and results, our professional opinion is that a **Seismic Site Classification of D** be considered for the project. Subsurface explorations at this site were extended to a maximum depth of 50.2 feet. The site properties below the exploration depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area.

### Liquefaction

Liquefaction occurs when a rapid buildup in water pressure, caused by ground motion, pushes sand particles apart, resulting in a loss of strength and later densification as the water pressure dissipates. This loss of strength can cause bearing capacity failure while the densification of liquefied layers after the earthquake can cause excessive settlement of the ground surface and structures.

The liquefaction potential of a site depends on the design earthquake's peak ground acceleration, which depends on the design earthquake's magnitude and the distance from the site to the design seismic event. The liquefaction potential also depends on the presence of granular soils below the water table, the relative densities of the granular soils, the percent fines of the soils, and the geologic ages of the soil deposits. The amount of ground surface settlement is dependent on the initial relative densities of the

soils which liquefy due to the earthquake. Based on the relatively mild ground motions associated with the design earthquake as indicated by the ASCE 7-22 Hazard Tool, the potential for liquefaction is negligible at this site.

## Geotechnical Overview

Based upon the geotechnical conditions observed in the CPT soundings and hand augers, the site generally appears suitable for the proposed construction, provided that the recommendations given herein are implemented in the design and construction phases of this project. Our earthwork recommendations include rolling the subgrade and remediation of soils that are not improved. Once the site has been prepared as discussed herein, the proposed structures may be supported on conventional shallow foundations.

Existing fill soils were encountered in the upper 1.0 to 1.8 feet at hand auger boring locations B-01s, B-05s, P-01s, P-03s, P-05s, and P-06s. The fill appears to be placed in a controlled manner but we have no records to indicate the degree of control. Support of floor slabs and pavements on or above existing fill soils is discussed in this report. However, even with the recommended construction procedures, inherent risk exists for the owner that compressible fill or unsuitable material, within or buried by the fill will, not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill but can be reduced by following the recommendations contained in this report. We recommend that the contractor submit a unit rate for undercutting as part of the bidding process. Further details are provided in the **Earthwork** section of this report.

The recommendations contained in this report are based upon the results of field and laboratory testing (presented in the **Exploration and Laboratory Results**), engineering analyses, and our current understanding of the proposed project. The **General Comments** section provides an understanding of the report limitations.

## Earthwork

Earthwork is anticipated to include demolition, clearing and grubbing, excavations, and engineered fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements.

## Demolition

Site preparation should begin with the demolition of the existing structures/pavements and debris removal. As part of the demolition, buried utilities and/or concrete foundations should also be removed. Existing utilities that are to be abandoned should be removed or filled with grout. The excavations resulting from foundation and utility removal should be properly backfilled with compacted structural fill as described in the following subsections. Utilities that are to remain in service should be accurately located horizontally and vertically to minimize conflict with new foundation construction.

## Subgrade Preparation

After stripping and removing topsoil and once any areas of cut have been excavated to proposed subgrade elevation, the exposed subgrade soils in the building and pavement footprints should be densified in place using a medium weight vibratory roller. The purpose of the vibratory rolling is to densify the exposed subgrade soils for floor slab and pavement support and to potentially improve the foundation bearing soils. The roller should make at least six passes across the site, with the second set of three passes perpendicular to the first set of three passes with intermittent vibration activated. If water is brought to the surface by the vibratory rolling, the operation should be discontinued until the water subsides. Vibratory rolling should be completed during dry weather. Static rolling and additional repairs should be anticipated for areas too wet for vibratory rolling.

After the vibratory rolling, pore pressures should be allowed to dissipate for a minimum of 16 hours. After the waiting period, proofrolling should be performed on the exposed subgrade soils in areas to receive fill or at the subgrade elevation with a loaded, tandem-axle dump truck (15 to 20 ton total vehicle weight) or similar rubber-tired construction equipment. Proofrolling is recommended as a means of detecting areas of soft or unstable subgrade soils. The proofrolling should be performed during a period of dry weather to avoid degrading an otherwise suitable subgrade. The proofrolling operations should be observed by a representative of the geotechnical engineer. Subgrade soils that exhibit excessive rutting or deflection during proofrolling should be repaired as directed by the field representative. Typical repairs include overexcavation followed by replacement with either properly compacted fill or by a subgrade stabilization fabric in conjunction with a sand fill or crushed stone.

If subgrade soils are unsuitable, they will require removal and replacement; however, if they are unstable due to excessive moisture, the most economical solution for remediation may be to scarify, dry and recompact the material. This remediation is most effective during the typically hotter months of the year (May to October). If construction is performed during the cooler period of the year, the timeline for scarifying, drying, and recompacting typically increases considerably and may lead to alternative remediation solutions. These solutions can include overexcavation of some or

all of the unstable material to be backfilled with either approved structural fill or geotextile and ABC Stone. Potential undercutting can be reduced if the site preparation work is performed during a period of dry weather and if construction traffic is kept to a minimum on prepared subgrades. We recommend that the contractor submit a unit rate cost for undercutting as part of the bidding process.

## Existing Fill

As noted in **Geotechnical Characterization**, existing fill soils were encountered in the upper 1.0 to 1.8 feet at each hand auger boring location. The fill appears to be placed in a controlled manner but we have no records to indicate the degree of control. Support of floor slabs and pavements on or above existing fill soils is discussed in this report. However, even with the recommended construction procedures, inherent risk exists for the owner that compressible fill or unsuitable material, within or buried by the fill will, not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill but can be reduced by following the recommendations contained in this report.

If the owner elects to construct the foundations, floor slabs, and pavements on the existing fill to reduce initial construction costs in exchange for increased potential longer-term distress, the following protocol should be followed prior to placing fill. Once any areas of cut are excavated to proposed subgrade elevation and after vibratory densification, the entire area should be proofrolled with heavy, rubber tire construction equipment, to aid in delineating areas of soft or otherwise unsuitable soil. Once unsuitable materials have been remediated and the subgrade has passed the proofroll test, the existing fill soils that were removed can be evaluated for reuse as structural fill.

## Excavation Considerations

We anticipate that excavations for the proposed construction can generally be accomplished with conventional earthmoving equipment.

**Excavation Safety:** As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local and/or state regulations.

Excavations or other activities resulting in ground disturbance have the potential to affect nearby structures, pavements, and utilities. Our scope of services does not include review of available final grading information or consider potential temporary grading performed by the contractor for potential effects such as ground movement beyond the project limits. A preconstruction/ precondition survey should be conducted to document nearby property/infrastructure prior to any site development activity. Excavation or ground disturbance activities should be monitored or instrumented for potential ground movements that could negatively affect nearby structures, pavements, and utilities.

Excavation should not be conducted below a downward 1:1 projection from existing foundations without engineering review of shoring requirements and geotechnical observation during construction.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety or the contractor's activities; such responsibility shall neither be implied nor inferred.

**Construction Dewatering:** Groundwater encountered in deeper excavations should be pumped out from sumps or well points. Pumping water, as required, should continue until excavations are completely backfilled.

The responsibility for dewatering of construction excavations and preventing excessive damage of existing and new buildings, structures, utilities, and other site improvements due to dewatering should lie solely with the contractor. This information is provided only as a service and under no circumstance should Terracon be assumed to be responsible for the effectiveness of the construction dewatering method(s) selected by the contractor.

## Fill Material Types

Fill required to achieve design grade should be classified as structural fill and general fill. Structural fill is material used below or within 10 feet of structures, pavements, site retaining walls, stormwater control measures, or constructed slopes. General fill is material used to achieve grade outside of these areas.

Material property requirements for on-site soil for use as general fill and structural fill are noted in the table below:

Property	General Fill	Structural Fill
Composition	Free of deleterious material	Free of deleterious material
Maximum particle size	6 inches (or 2/3 of the lift thickness)	3 inches
Fines content	Not limited	Not limited
Plasticity	Not limited	Maximum liquid limit of 50 Maximum plasticity index of 20

Earthen materials used for structural or general fill should meet the following material property requirements:

Soil Type <sup>1</sup>	USCS Classification	Acceptable Location for Placement
Imported Soil	GW, GP, GM, GC, SM, SP, SP-SM, SP-SC, SC-SM	All locations and elevations
On-Site Soils	SP, SP-SM, SM <sup>2</sup> (LL<50 or PI<20)	All locations and elevations
	CL <sup>3</sup> , CH <sup>3</sup>	General fill only (>5 feet outside of construction footprint)

1. Structural fill should consist of approved materials free of organic matter and debris. Frozen materials should not be used, and fill should not be placed on frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site.
2. Reuse of clayey sand (SC) material could lead to delays in construction depending on moisture conditions at the site at that time.
3. Fine-grained soils such as clays and silts should not be reused as structural fill due to their moisture sensitivity when compared to the sandier soils available.

## Fill Placement and Compaction Requirements

Structural and general fill should meet the following compaction requirements.

Item	Structural Fill	General Fill
<b>Maximum Lift Thickness</b>	8 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches in loose thickness when hand-guided equipment (i.e. trench roller, jumping jack, or plate compactor) is used	Same as structural fill
<b>Minimum Compaction Requirements</b> <sup>1,2,3</sup>	95% of maximum 98% of maximum in upper 1 foot of structural fill	92% of max.
<b>Water Content Range</b> <sup>1, 3</sup>	Within 3 percent of optimum moisture content	As required to achieve min. compaction requirements

Item	Structural Fill	General Fill
1.	Fill should be tested for moisture content and compaction during placement. If in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the tests should be reworked and retested as required until the specified moisture and compaction requirements are achieved.	
2.	It is not necessary to achieve 95% compaction on the existing ground prior to placing fill or beginning construction. However, the subgrade should be evaluated by the Geotechnical Engineer prior to placing fill or beginning construction.	
3.	Maximum density and optimum water content as determined by the standard Proctor test (ASTM D 698).	
4.	Materials not amenable to density testing should be placed and compacted to a stable condition observed by the Geotechnical Engineer or representative.	

## Pipe Bedding and Trench Backfill

Pipe bedding and trench backfill should be in accordance with the applicable public works standard details and specifications for the type of pipe to be supported. (For example, the NCDOT has published standard pipe bedding and backfilling details for flexible and rigid pipe for normal earth foundation, rock foundation, and unsuitable material foundation conditions.) Backfill materials, placement, and testing should be in accordance with the public works requirements or the earthwork recommendations given in this report, whichever are more stringent. If open-graded materials, such as No. 78 or No. 57 stone, are used, they should be completely wrapped in a woven geotextile that can be used for both separation and filtration (e.g., Mirafi HP270).

## Subgrade Protection

Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of grade-supported improvements such as floor slabs and pavements. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent surface water from ponding on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompact prior to floor slab construction.

All grades must provide effective drainage away from the building during and after construction and should be maintained throughout the life of the structure. Water retained next to the building can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. The roof should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 10 feet from the building.

## Construction Observation and Testing

The earthwork efforts should be observed by the Geotechnical Engineer (or others under their direction). Observation should include documentation of adequate removal of surficial materials (vegetation, topsoil, and pavements), evaluation and remediation of existing fill materials, as well as proofrolling and mitigation of unsuitable areas delineated by the proofroll.

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, as recommended by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,500 square feet of compacted fill in the building areas and 5,000 square feet in pavement areas. Where not specified by local ordinance, one density and water content test should be performed for every 100 linear feet of compacted utility trench backfill and a minimum of one test performed for every 12 vertical inches of compacted backfill.

In areas of foundation excavations, the bearing subgrade should be evaluated by the Geotechnical Engineer. The bottom of footings should be checked with hand augers and Dynamic Cone Penetrometer (DCP) testing that extend through any new or existing fill material. If unanticipated conditions are observed, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

## Shallow Foundations

If the site has been prepared in accordance with the requirements noted in [Earthwork](#), the following design parameters are applicable for shallow foundations.

## Design Parameters – Compressive Loads

Item	Description
<b>Maximum Net Allowable Bearing Pressure</b> <sup>1, 2</sup>	2,000 psf
<b>Required Bearing Stratum</b> <sup>3</sup>	Approved existing soils or structural fill
<b>Minimum Foundation Dimensions</b>	Columns: 24 inches Continuous: 16 inches
<b>Sliding Resistance</b> <sup>4</sup>	0.35 ultimate coefficient of friction - granular material
<b>Minimum Embedment below Finished Grade</b> <sup>5</sup>	12 inches
<b>Estimated Total Settlement from Structural Loads</b> <sup>2</sup>	Less than 1 inch
<b>Estimated Differential Settlement</b> <sup>2, 6</sup>	About 1/2 of total settlement

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Values assume that exterior grades are no steeper than 20% within 10 feet of structure. The allowable bearing pressure can be increased by  $\frac{1}{3}$  for use with the alternative load combinations given in Section 1605.3.2 of the 2018 North Carolina Building Code. Please note, however, that additional foundation settlement will occur under these load combinations.
2. Values provided are for maximum loads noted in [Project Description](#). Additional geotechnical consultation will be necessary if higher loads are anticipated.
3. Unsuitable or soft soils should be overexcavated and replaced per the recommendations presented in [Earthwork](#).
4. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Frictional resistance for granular materials is dependent on the bearing pressure which may vary due to load combinations. For fine-grained materials, lateral resistance using cohesion should not exceed  $\frac{1}{2}$  the dead load.
5. Embedment necessary to minimize the effects of frost and to achieve recommended allowable bearing pressure with a factor of safety of at least 2.5. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.
6. Differential settlements are noted for equivalent-loaded foundations and bearing elevation as measured over a span of 50 feet.

## Design Parameters – Overturning and Uplift Loads

Shallow foundations subjected to overturning loads should be proportioned such that the resultant eccentricity is maintained in the center-third of the foundation (e.g.,  $e < b/6$ , where  $b$  is the foundation width). This requirement is intended to keep the entire

foundation area in compression during the extreme lateral/overturning load event. Foundation oversizing may be required to satisfy this condition.

Uplift resistance of spread footings can be developed from the effective weight of the footing and the overlying soils with consideration to the IBC basic load combinations.

Item	Description
Soil Moist Unit Weight	110 pcf
Soil Effective Unit Weight <sup>1</sup>	48 pcf
Soil weight included in uplift resistance	Soil included within the prism extending up from the top perimeter of the footing at an angle of 15 degrees from vertical to ground surface

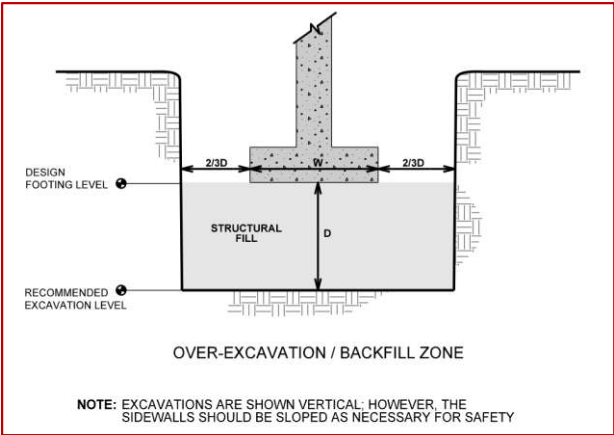
1. Effective (or buoyant) unit weight should be used for soil above the foundation level and below a water level. The high groundwater level should be used in uplift design as applicable.

### Foundation Construction Considerations

The foundation bearing materials should be evaluated at the time of the foundation excavation. This is an essential part of the construction process. A representative of the geotechnical engineer should use a combination of hand auger borings and dynamic cone penetrometer (DCP) testing to determine the suitability of the bearing materials for the design bearing pressure. DCP testing should be performed to a depth of 3 to 5 feet below the bottom of foundation excavation and through newly placed or existing fill soils. Excessively soft, loose, or wet bearing soils should be over excavated to a depth recommended by the geotechnical engineer. The excavated soils should be replaced with structural fill or washed, crushed stone (NCDOT No. 57) wrapped in a geotextile fabric (Mirafi HP270 or equivalent). The need for the geotextile fabric with the crushed stone should be determined by the Geotechnical Engineer during construction based on sloughing/caving soils and excavation observations. However, footings could bear directly on the soils after over excavation if approved by the Geotechnical Engineer.

The base of all foundation excavations should be free of water and loose soil prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Should the soils at bearing level become excessively disturbed or saturated, the affected soil should be removed prior to placing concrete.

Overexcavation for structural fill placement below footings should be conducted as shown below. The overexcavation should be backfilled up to the footing base elevation, with structural fill placed, as recommended in the [Earthwork](#) section or washed crushed stone (NCDOT No. 57) wrapped in a woven geotextile that can be used for both separation and filtration (e.g., Mirafi HP270).



## Floor Slabs

Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure and positive drainage of the aggregate base beneath the floor slab.

Existing fill materials were observed at each hand auger boring locations extending to depths of 1.0 to 1.8 feet below existing grade. As previously described, any existing fill present beneath floor slabs should be evaluated by the Geotechnical Engineer as noted in the **Existing Fill** section within **Earthwork**.

### Floor Slab Design Parameters

Item	Description
<b>Floor Slab Support<sup>1</sup></b>	Suitable existing soils or new structural fill compacted in accordance with <b>Earthwork</b> section of this report.
<b>Estimated Modulus of Subgrade Reaction<sup>2</sup></b>	150 pounds per square inch per inch (psi/in) for point loads
<b>Aggregate Base Course/Capillary Break<sup>3</sup></b>	<ul style="list-style-type: none"><li>■ Minimum 4 inches of free-draining granular material (less than 5% passing the U.S. No. 200 sieve)</li><li>■ Aggregate Base Course can be used for slabs above exterior grade</li></ul>

1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.
2. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in **Earthwork**, and the floor slab support as

Item	Description
	noted in this table. It is provided for point loads. For large area loads the modulus of subgrade reaction would be lower.
3.	Free-draining granular material should have less than 5% fines (material passing the No. 200 sieve). Other design considerations such as cold temperatures and condensation development could warrant more extensive design provisions.

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, when the project includes humidity-controlled areas, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut contraction joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations, refer to the ACI Design Manual. Joints or cracks should be sealed with a waterproof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

Settlement of floor slabs supported on existing fill materials cannot be accurately predicted but could be larger than normal and result in some cracking. Mitigation measures, as noted in **Existing Fill** within **Earthwork**, are critical to the performance of floor slabs. In addition to the mitigation measures, the floor slab can be stiffened by adding steel reinforcement, grade beams, and/or post-tensioned elements.

## Floor Slab Construction Considerations

On most project sites, the site grading is generally accomplished early in the construction phase. However, as construction proceeds, the subgrade may be disturbed due to utility excavations, construction traffic, desiccation, rainfall, etc. As a result, the floor slab subgrade may not be suitable for placement of base stone and concrete and corrective action will be required to repair the damaged areas.

Finished subgrade, within and for at least 10 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or

desiccated prior to construction of floor slabs, the affected material should be removed, and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should observe the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

## Pavements

Pavement designs are provided for the traffic conditions and pavement life conditions as noted in [Project Description](#). A critical aspect of pavement performance is site preparation. Pavement designs noted in this section must be applied to the site which has been prepared as recommended in the [Earthwork](#) section.

### Pavement Design Parameters

A California Bearing Ratio (CBR) of 8 was used for the subgrade for the asphaltic concrete (AC) pavement designs. A modulus of subgrade reaction of 150 psi/in was used for the Portland cement concrete (PCC) pavement designs. The value was empirically derived based upon our experience with the sandy subgrade soils and our expectation of the quality of the subgrade as prescribed by the **Site Preparation** conditions as outlined in [Earthwork](#). A modulus of rupture of 580 psi was used in design for the concrete (based on correlations with a minimum 28-day compressive strength of 4,000 psi).

### Pavement Section Thicknesses

The following table provides our opinion of minimum thickness for AC sections:

### Asphaltic Concrete Design

Layer	Thickness (inches)		
	NCDOT Grading <sup>1</sup>	Automobile Areas (Light Duty)	Main Drives and Truck Access Areas (Medium Duty)
AC Surface	S-9.5B	3 <sup>2</sup>	1.5
AC Intermediate	I-19.0C	--	2.5
Aggregate Base	ABC	6	8

1. All materials should meet the current North Carolina Department of Transportation Standard Specifications
2. Placed in two equal lifts.
3. See [Project Description](#) for more specifics regarding traffic assumptions.

The following table provides our estimated minimum thickness of PCC pavements.

### Portland Cement Concrete Design

Layer	Specification <sup>1</sup>	Thickness (inches)		
		Automobile Areas (Light Duty)	Main Drives and Truck Access Areas (Medium Duty)	Heavy Duty <sup>2</sup>
PCC	4,000 psi	5	6	8
Aggregate Base	ABC <sup>3</sup>	4	4	4

1. All materials should meet the current North Carolina Department of Transportation (NCDOT) Standard Specifications.
2. In areas of anticipated heavy traffic, fire trucks, delivery trucks, or concentrated loads (e.g. dumpster pads), and areas with repeated turning or maneuvering of heavy vehicles.
3. Crushed Aggregate Base Course is recommended for construction purposes. Concrete could be placed directly on an approved subgrade. However, stormwater can quickly degrade exposed subgrades without the crushed aggregate base course leading to additional subgrade repair.
4. See [Project Description](#) for more specifics regarding traffic assumptions.

Areas for parking of heavy vehicles, concentrated turn areas, and start/stop maneuvers could require thicker pavement sections. Edge restraints (i.e. concrete curbs or aggregate shoulders) should be planned along curves and areas of maneuvering vehicles.

The base course layer is recommended to help reduce potential for slab curl, shrinkage cracking, and subgrade pumping through joints. Proper joint spacing will also be

required to prevent excessive slab curling and shrinkage cracking. Joints should be sealed to prevent entry of foreign material and doweled where necessary for load transfer. PCC pavement details for joint spacing, joint reinforcement, and joint sealing should be prepared in accordance with ACI 330 and ACI 325.

Where practical, we recommend early-entry cutting of crack-control joints in PCC pavements. Cutting of the concrete in its “green” state typically reduces the potential for micro-cracking of the pavements prior to the crack control joints being formed, compared to cutting the joints after the concrete has fully set. Micro-cracking of pavements may lead to crack formation in locations other than the sawed joints, and/or reduction of fatigue life of the pavement.

The placement of a partial pavement thickness for use during construction is not suggested without a detailed pavement analysis incorporating construction traffic. If the actual traffic varies from the assumptions outlined in [Project Description](#) we should be contacted to update our recommendations as necessary.

## Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the granular subbase.

## Pavement Maintenance

The pavement sections represent minimum recommended thicknesses and, as such, periodic upkeep should be anticipated. Preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Pavement care consists of both localized (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Additional engineering consultation is recommended to determine the type and extent of a cost-effective program. Even with periodic maintenance, some movements and related cracking may still occur, and repairs may be required.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to paved areas should slope down from the edges at a minimum 2%.

- Subgrade and pavement surfaces should have a minimum 2% slope to promote proper surface drainage.
- Install pavement drainage systems surrounding areas anticipated for frequent wetting.
- Install joint sealant and seal cracks immediately.
- Seal all landscaped areas in or adjacent to pavements to reduce moisture migration to subgrade soils.
- Place compacted, low permeability backfill against the exterior side of curb and gutter.
- Place curb, gutter and/or sidewalk directly on clay subgrade soils rather than on unbound granular base course materials.

## Stormwater Control Measures

We understand the existing stormwater infiltration basin on site will be utilized for stormwater control. The attached report by Terrain Environmental in [Supporting Information](#) provides a summary of the observed seasonal high water table and infiltration rates measured at the locations tested within the existing infiltration basin.

## General Comments

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-

party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly effect excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety and cost estimating including excavation support and dewatering requirements/design are the responsibility of others. Construction and site development have the potential to affect adjacent properties. Such impacts can include damages due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, as well as noise or air quality concerns. Evaluation of these items on nearby properties are commonly associated with contractor means and methods and are not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of surrounding development. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

## Geotechnical Engineering Report

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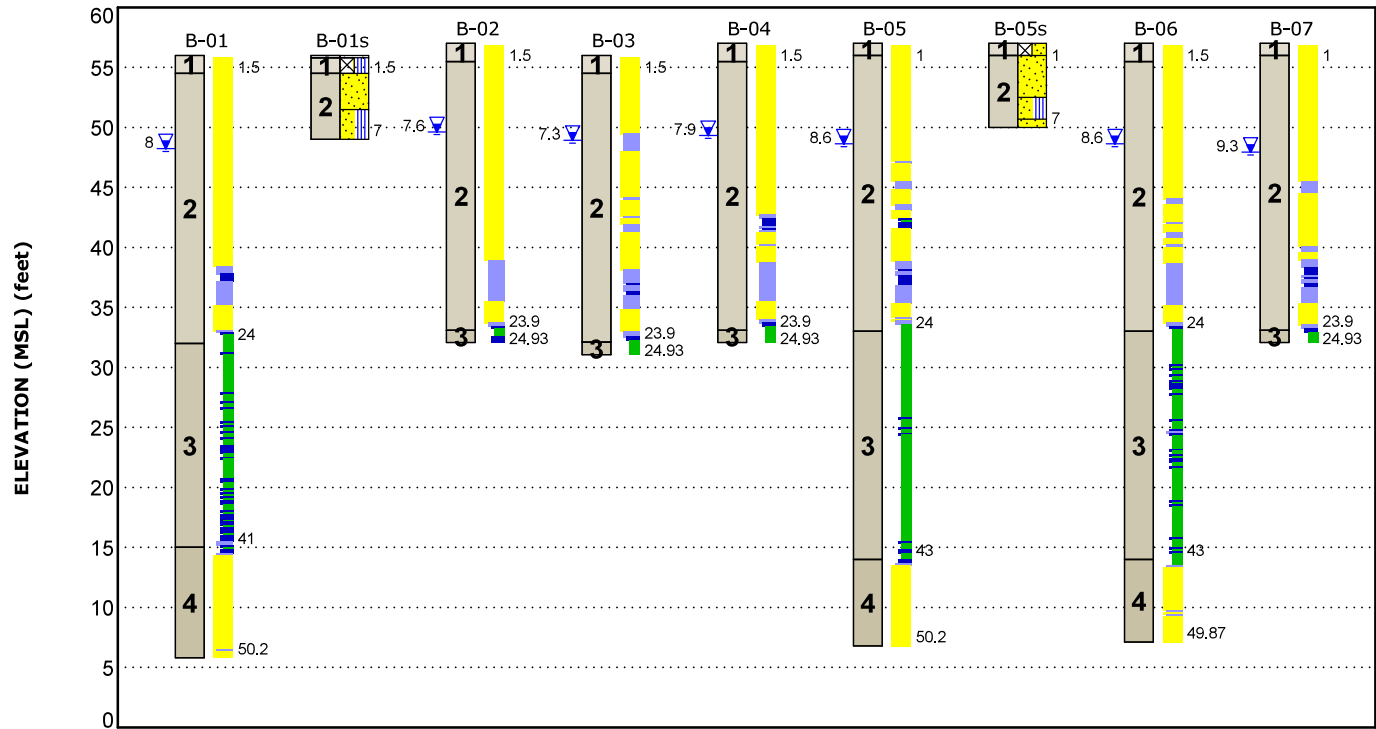


# Figures

## Contents:

GeoModel

GeoModel



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description	Legend	
1	Existing Fill	Poorly graded sand	Topsoil	Poorly-graded Sand with Silt
2	Sand	Loose to medium dense sand	Poorly-graded Sand	
3	Clay	Soft to medium stiff clay		
4	Underlying Sand	Medium dense to dense sand		
5	Castle Hayne Formation	Indicated by CPT refusal		

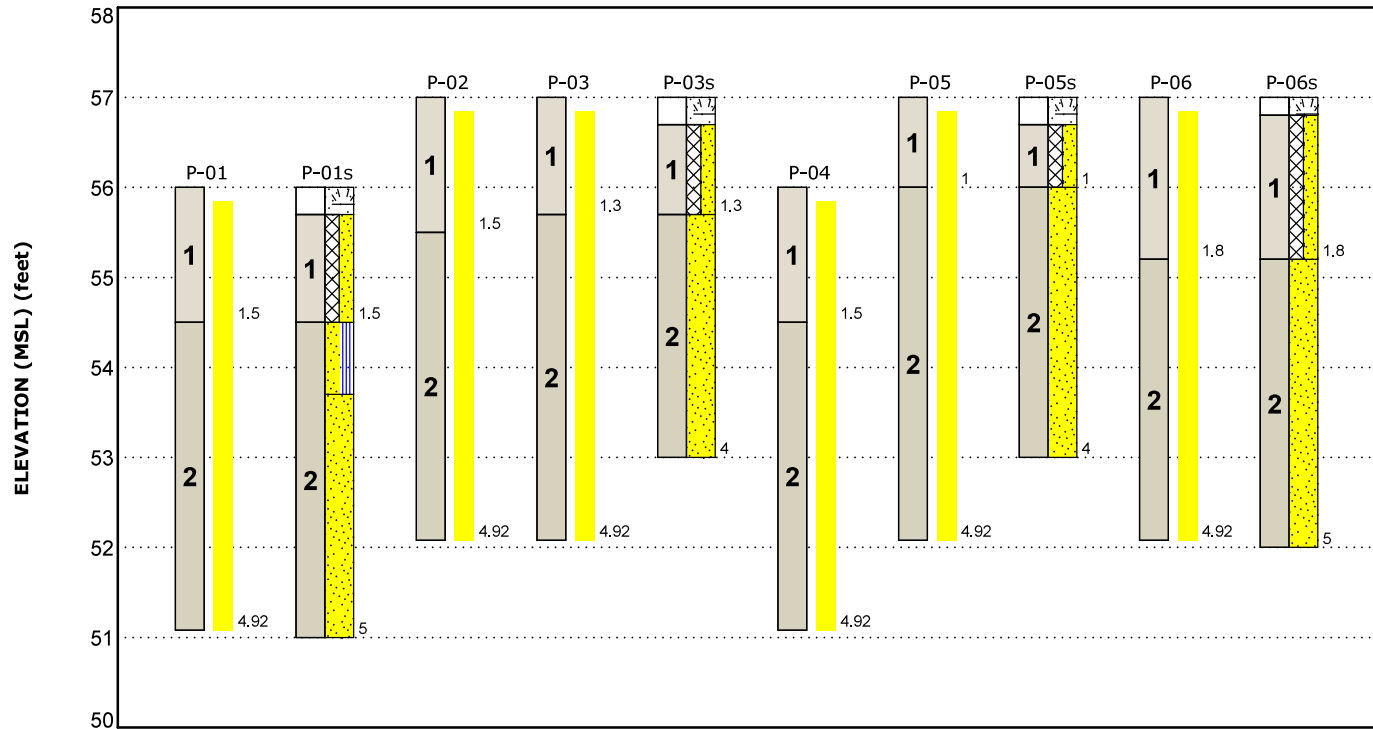
Soil Behavior Type (SBT)

7 Gravelly sand to dense sand	8 Very stiff sand to clayey sand	3 Clay - silty clay to clay
1 Sensitive, fine grained	2 Organic soils - clay	6 Sands - clean sand to silty sand
4 Silt mixtures - clayey silt to silty clay	5 Sand mixtures - silty sand to sandy silt	9 Very stiff fine grained

CPT Assumed Water Depth

NOTES:  
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

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## Attachments

# Exploration and Testing Procedures

## Field Exploration

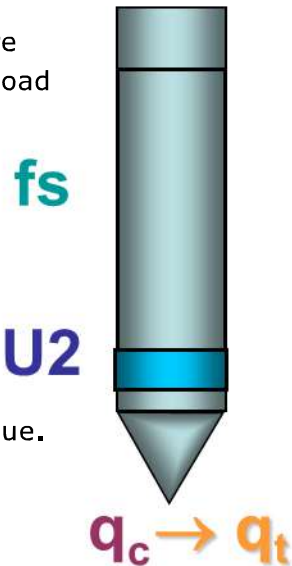
Number of Soundings	Approximate Sounding Depth (feet) <sup>1</sup>	Location
7	25 to 50	Proposed Building
6	5	Proposed Pavement

1. Referenced from existing ground surface.

**Exploration Layout and Elevations:** Terracon personnel provided the exploration layout using handheld GPS equipment (estimated horizontal accuracy of about ±10 feet) and referencing existing site features. Approximate ground surface elevations were obtained by interpolation from the provided topographic map. If elevations and a more precise exploration layout are desired, we recommend our locations be surveyed.

**Subsurface Exploration Procedures:** The subsurface exploration was performed by a track mounted power drilling rig utilizing direct push, cone penetration testing (CPT) to advance into the subsurface. Additionally, six (6) hand auger borings were advanced to depths of 4 to 7 feet below existing grades to obtain laboratory samples and visually classify near-surface soils. Samples were tagged for identification, sealed to reduce moisture loss, and taken to our laboratory for further examination, testing, and classification.

**Cone Penetration Testing (CPT):** The CPT hydraulically pushes an instrumented cone through the soil while nearly continuous readings are recorded to a portable computer. The cone is equipped with electronic load cells to measure tip resistance and sleeve resistance and a pressure transducer to measure the generated ambient pore pressure. The face of the cone has an apex angle of 60° and an area of 10 cm<sup>2</sup>. Digital data representing the tip resistance, friction resistance, pore water pressure, and probe inclination angle are recorded about every 2 centimeters while advancing through the ground at a rate between 1½ and 2½ centimeters per second. These measurements are correlated to various soil properties used for geotechnical design. No soil samples are gathered through this subsurface investigation technique.



CPT testing is conducted in general accordance with ASTM D5778 "Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils." Upon completion, the data collected was downloaded and processed by the project engineer.

Shear wave velocity testing is a supplement to the CPT with added instrumentation used to determine shear wave velocity with depth. This additional information is collected via an accelerometer placed above the instrumented cone. A shear wave is generated at the ground surface, such as a hammer striking a steel plate on the end, which propagates through the soil and is recorded by the accelerometer at selected intervals (typically 1 meter). From this data, the interval shear wave velocities of the soil are calculated. These interval velocities can be used to develop the shear wave velocity profile for the site and can be used to determine a seismic site classification.

## Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests. The laboratory testing program included the following types of tests:

- Moisture Content
- Grain-Size Analysis
- Atterberg Limits
- Moisture Density Relationship
- California Bearing Ratio

The laboratory testing program often included examination of soil samples by an engineer. Based on the results of our field and laboratory programs, we described and classified the soil samples in accordance with the Unified Soil Classification System.

## Photography Log

Photos taken during site visit on November 18, 2024



**Photo 1:** Site looking south



**Photo 2:** Existing stormwater infiltration basin

## Site Location and Exploration Plan

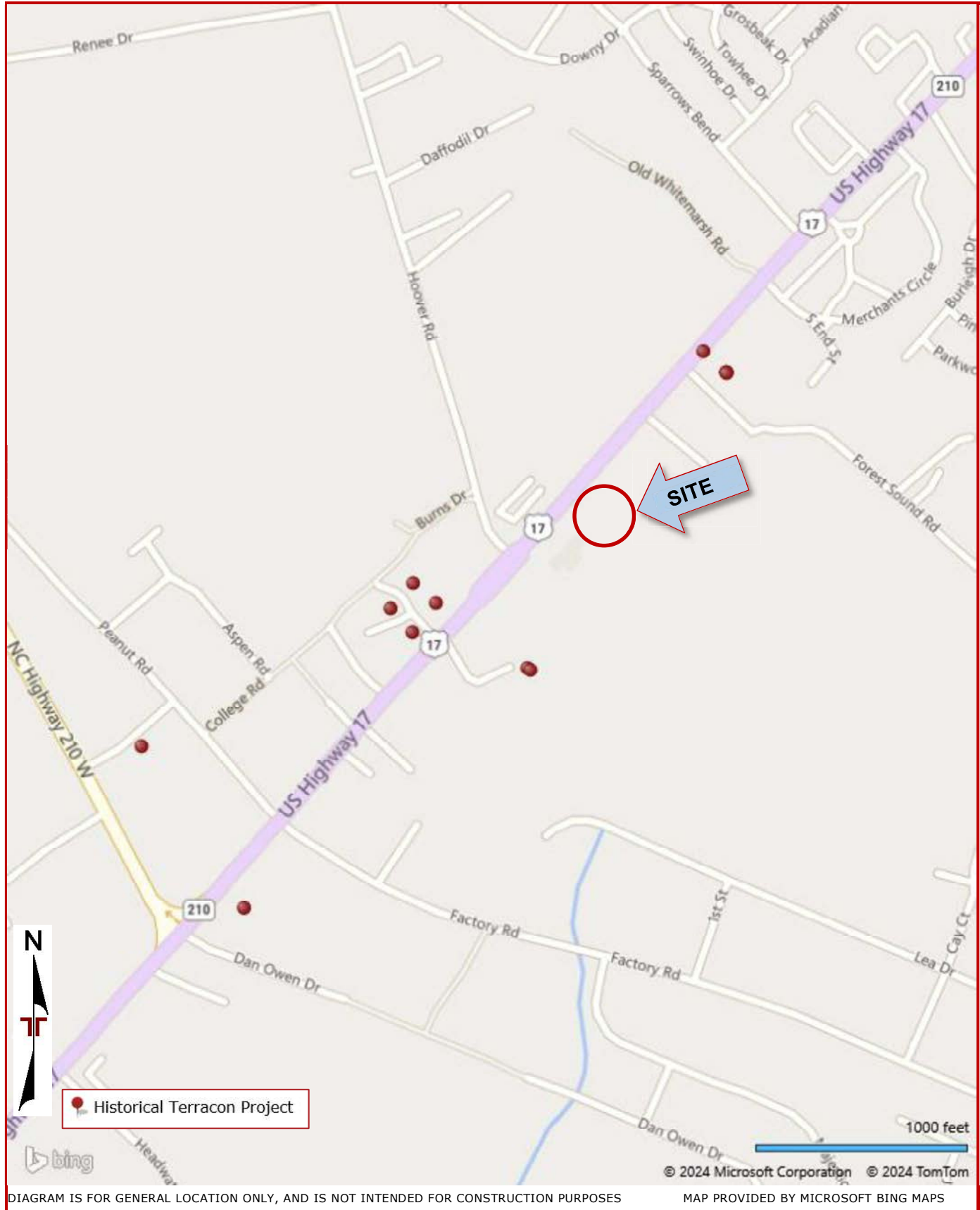
### **Contents:**

Site Location

Exploration Plan

Note: All attachments are one page unless noted above.

## Site Location



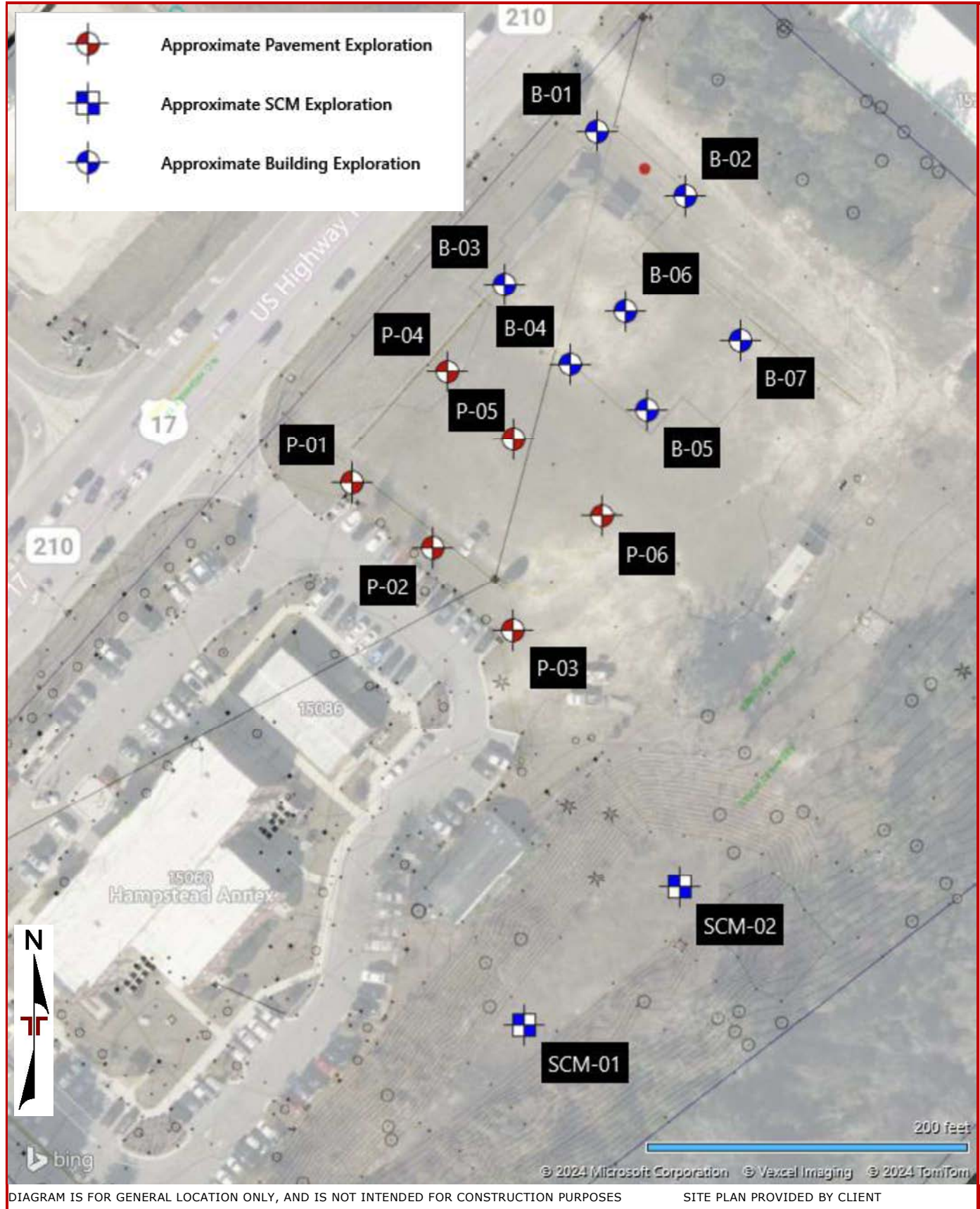
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## Exploration Plan



# Exploration and Laboratory Results

## **Contents:**

CPT Sounding and Hand Auger Boring Logs

-B-01 through B-07

-P-01 through P-06

Summary of Laboratory Results

Grain Size Distribution

Atterberg Limits

Moisture-Density Relationship

Report for California Bearing Ratio

Note: All attachments are one page unless noted above.

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# CPT Sounding ID B-01

Latitude: 34.3722° Longitude: -77.7053°

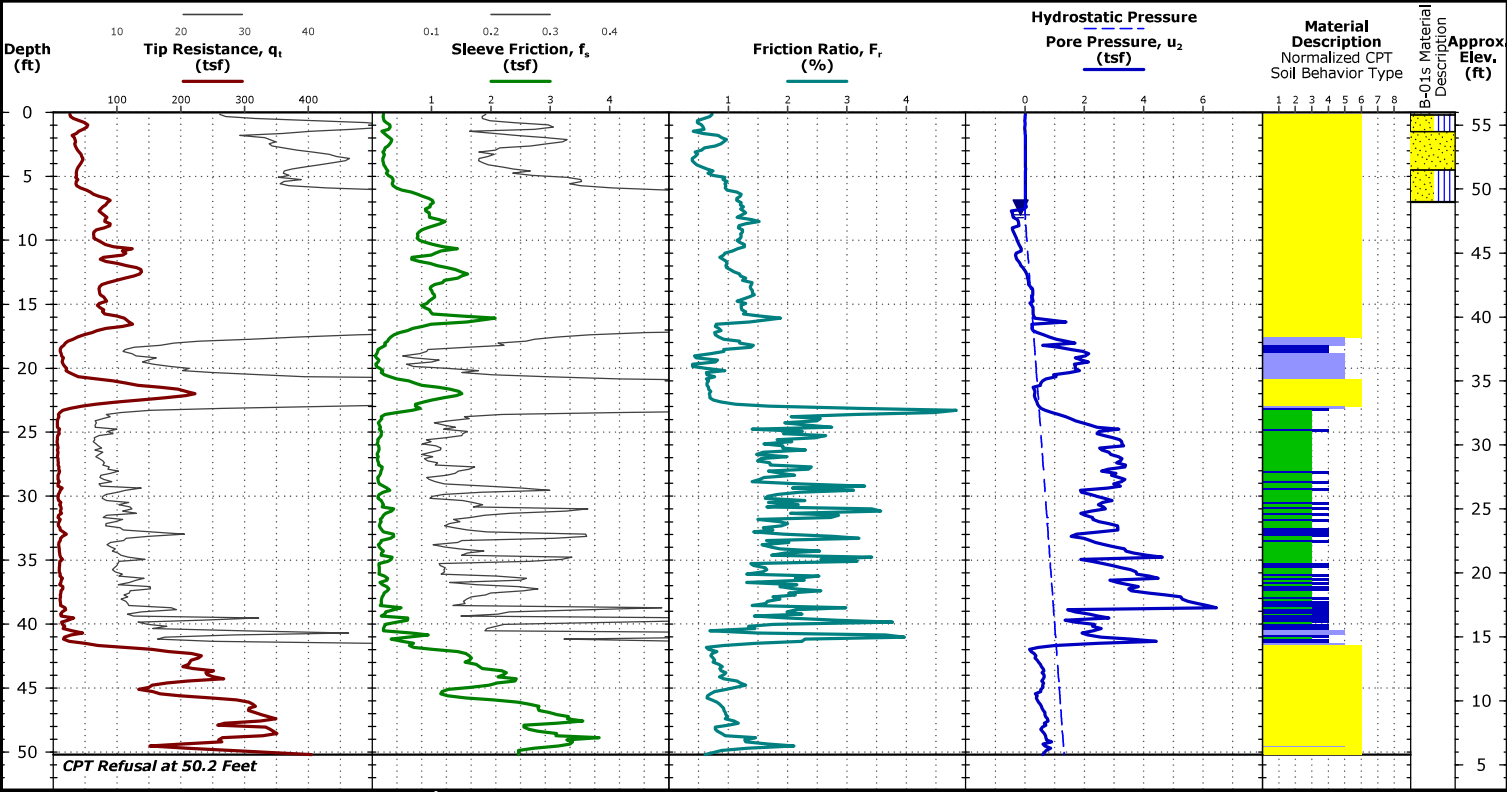


2108 Capital Dr, Ste 103  
Wilmington, NC

Elevation: 56 (ft) +/-

Elevation Reference: Elevations were interpolated from a topographic site plan.

CPT Started: 11/21/2024  
CPT Completed: 11/21/2024



See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data, if any.  
See [Supporting Information](#) for explanation of symbols and abbreviations.

**Notes**  
Test Location: See [Exploration Plan](#)  
See B-01s for the adjacent test's full details.

**CPT Equipment**  
CPT Rig: MST-300VDL  
Operator: J. Duffy  
CPT sensor calibration reports available upon request  
Probe No. DDG1299 with net area ratio of .8  
U<sub>2</sub> pore pressure transducer location  
Manufactured by Vertek- Calibrated 9/24/2020  
Tip and sleeve areas of 10 cm<sup>2</sup> and 150 cm<sup>2</sup>  
Ring friction reducer with O.D. of 1.8973 in

**Water Level Observation**  
8 ft measured water depth  
(used in normalizations and correlations)

**Normalized Soil Behavior Type (Robertson 1990)**  
1 Sensitive, fine grained  
2 Organic soils - clay  
3 Clay - silty clay to clay  
4 Silt mixtures - clayey silt to silty clay  
5 Sand mixtures - silty sand to sandy silt  
6 Sands - clean sand to silty sand  
7 Gravelly sand to dense sand  
8 Very stiff sand to clayey sand  
9 Very stiff fine grained

Boring Log No. B-01s

Model Layer	Graphic Log	Location: See <a href="#">Exploration Plan</a> Latitude: 34.3722° Longitude: -77.7053°		Depth (Ft.)	Water Level Observations	Sample Type	Water Content (%)	Atterberg Limits	Percent Fines
		Depth (Ft.)	Elevation: 56 (Ft.) +/-					LL-PL-PI	
		0.2	<b>TOPSOIL</b> , 2 inches	55.8					
1			<b>FILL - POORLY GRADED SAND WITH SILT</b> , fine to medium, gray and white		1				
		1.5		54.5			3.8	NP	5
2			<b>POORLY GRADED SAND (SP)</b> , fine to medium, brown and tan		2				
					3				
					4				
		4.5		51.5					
			<b>POORLY GRADED SAND WITH SILT (SP-SM)</b> , fine to medium, dark brown		5				
					6				
		7.0		49	7				
		<b>Boring Terminated at 7 Feet</b>							
<p>See <a href="#">Exploration and Testing Procedures</a> for a description of field and laboratory procedures used and additional data (If any).</p> <p>See <a href="#">Supporting Information</a> for explanation of symbols and abbreviations.</p> <p>Elevation Reference: Elevations were interpolated from a topographic site plan.</p>				<b>Water Level Observations</b> Groundwater not encountered			<b>Drill Rig</b> N/A		
							<b>Hammer Type</b> N/A		
							<b>Driller</b> N. Lindley		
				<b>Advancement Method</b> Hand Auger			<b>Logged by</b> N. Lindley		
<b>Notes</b>				<b>Abandonment Method</b> Boring backfilled with soil cuttings upon completion.			<b>Boring Started</b> 11-26-2024		
							<b>Boring Completed</b> 11-26-2024		

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Terracon Project No. K6245099

## CPT Sounding ID B-02

Latitude: 34,3721° Longitude: -77,7051°

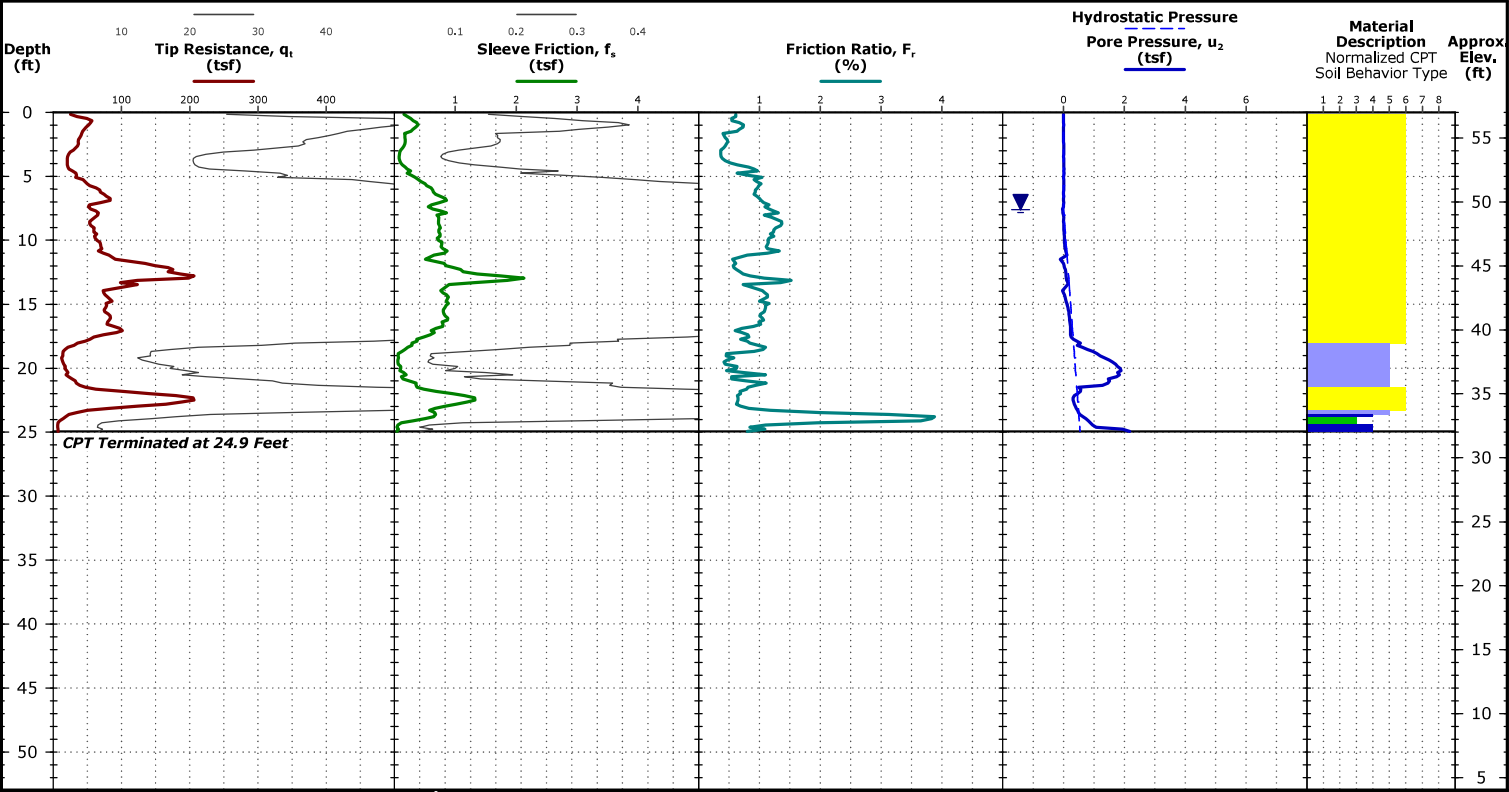


2108 Capital Dr, Ste 103  
Wilmington, NC

Elevation: 57 (ft) +/-

Elevation Reference: Elevations were interpolated from a topographic site plan.

CPT Started: 11/21/2024  
CPT Completed: 11/21/2024



See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data, if any.  
See [Supporting Information](#) for explanation of symbols and abbreviations.

### Notes

Test Location: See [Exploration Plan](#)

### CPT Equipment

CPT Rig: MST-300VDL  
Operator: J. Duffy  
CPT sensor calibration reports available upon request  
Probe No. DDG1299 with net area ratio of .8  
U<sub>2</sub> pore pressure transducer location  
Manufactured by Vertek- Calibrated 9/24/2020  
Tip and sleeve areas of 10 cm<sup>2</sup> and 150 cm<sup>2</sup>  
Ring friction reducer with O.D. of 1.8973 in

### Water Level Observation

7.6 ft measured water depth  
(used in normalizations and correlations)

### Normalized Soil Behavior Type (Robertson 1990)

- 1 Sensitive, fine grained
- 2 Organic soils - clay
- 3 Clay - silty clay to clay
- 4 Silt mixtures - clayey silt to silty clay
- 5 Sand mixtures - silty sand to sandy silt
- 6 Sands - clean sand to silty sand
- 7 Gravelly sand to dense sand
- 8 Very stiff sand to clayey sand
- 9 Very stiff fine grained

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Terracon Project No. K6245099

## CPT Sounding ID B-03

Latitude: 34,3719° Longitude: -77,7055°

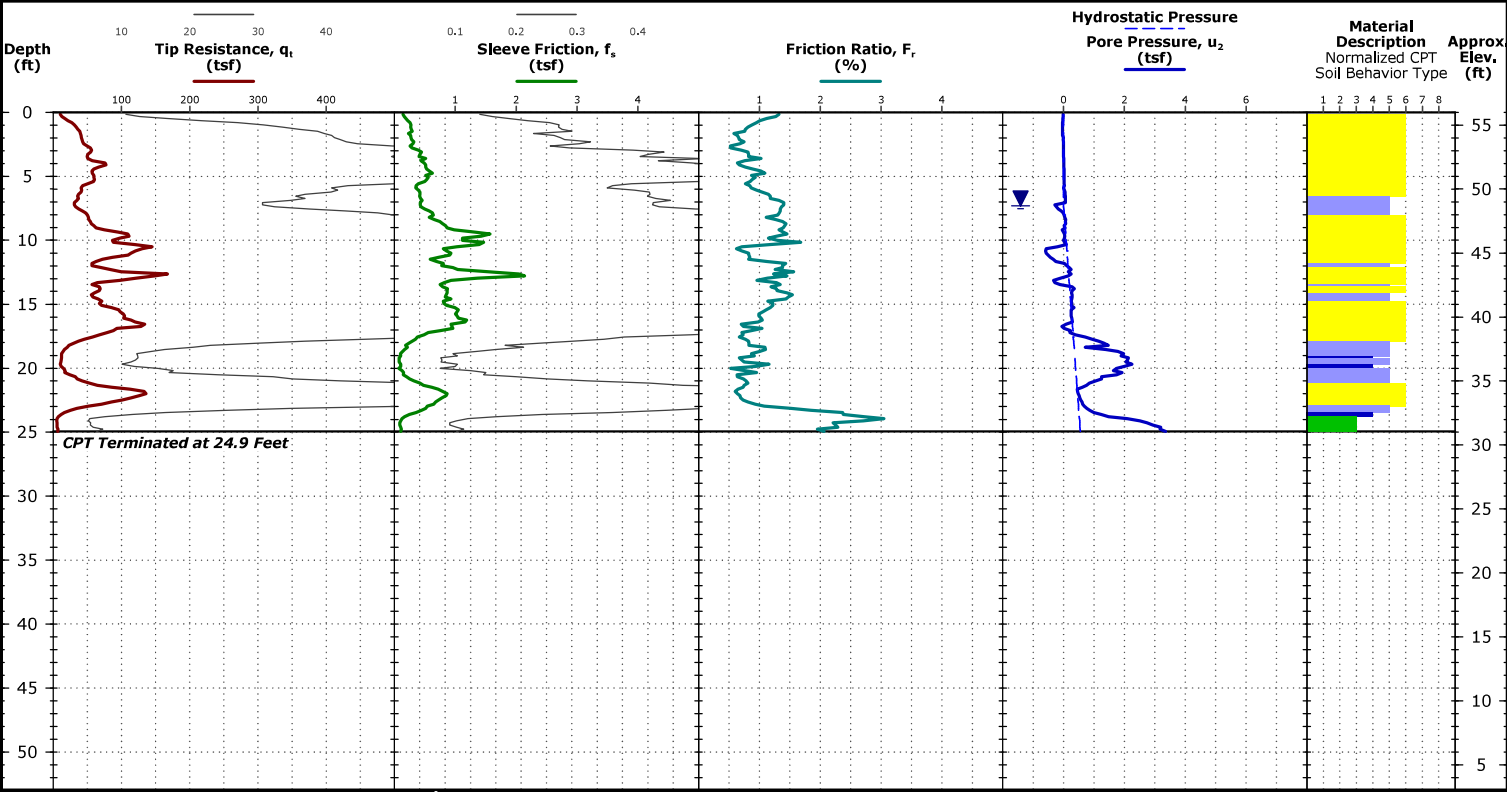


2108 Capital Dr, Ste 103  
Wilmington, NC

Elevation: 56 (ft) +/-

Elevation Reference: Elevations were interpolated from a topographic site plan.

CPT Started: 11/21/2024  
CPT Completed: 11/21/2024



See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data, if any.  
See [Supporting Information](#) for explanation of symbols and abbreviations.

### Notes

Test Location: See [Exploration Plan](#)

### CPT Equipment

CPT Rig: MST-300VDL  
Operator: J. Duffy  
CPT sensor calibration reports available upon request  
Probe No. DDG1299 with net area ratio of .8  
U<sub>2</sub> pore pressure transducer location  
Manufactured by Vertek- Calibrated 9/24/2020  
Tip and sleeve areas of 10 cm<sup>2</sup> and 150 cm<sup>2</sup>  
Ring friction reducer with O.D. of 1.8973 in

### Water Level Observation

7.3 ft measured water depth  
(used in normalizations and correlations)

### Normalized Soil Behavior Type (Robertson 1990)

- 1 Sensitive, fine grained
- 2 Organic soils - clay
- 3 Clay - silty clay to clay
- 4 Silt mixtures - clayey silt to silty clay
- 5 Sand mixtures - silty sand to sandy silt
- 6 Sands - clean sand to silty sand
- 7 Gravelly sand to dense sand
- 8 Very stiff sand to clayey sand
- 9 Very stiff fine grained

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Terracon Project No. K6245099

## CPT Sounding ID B-04

Latitude: 34,3718° Longitude: -77,7053°



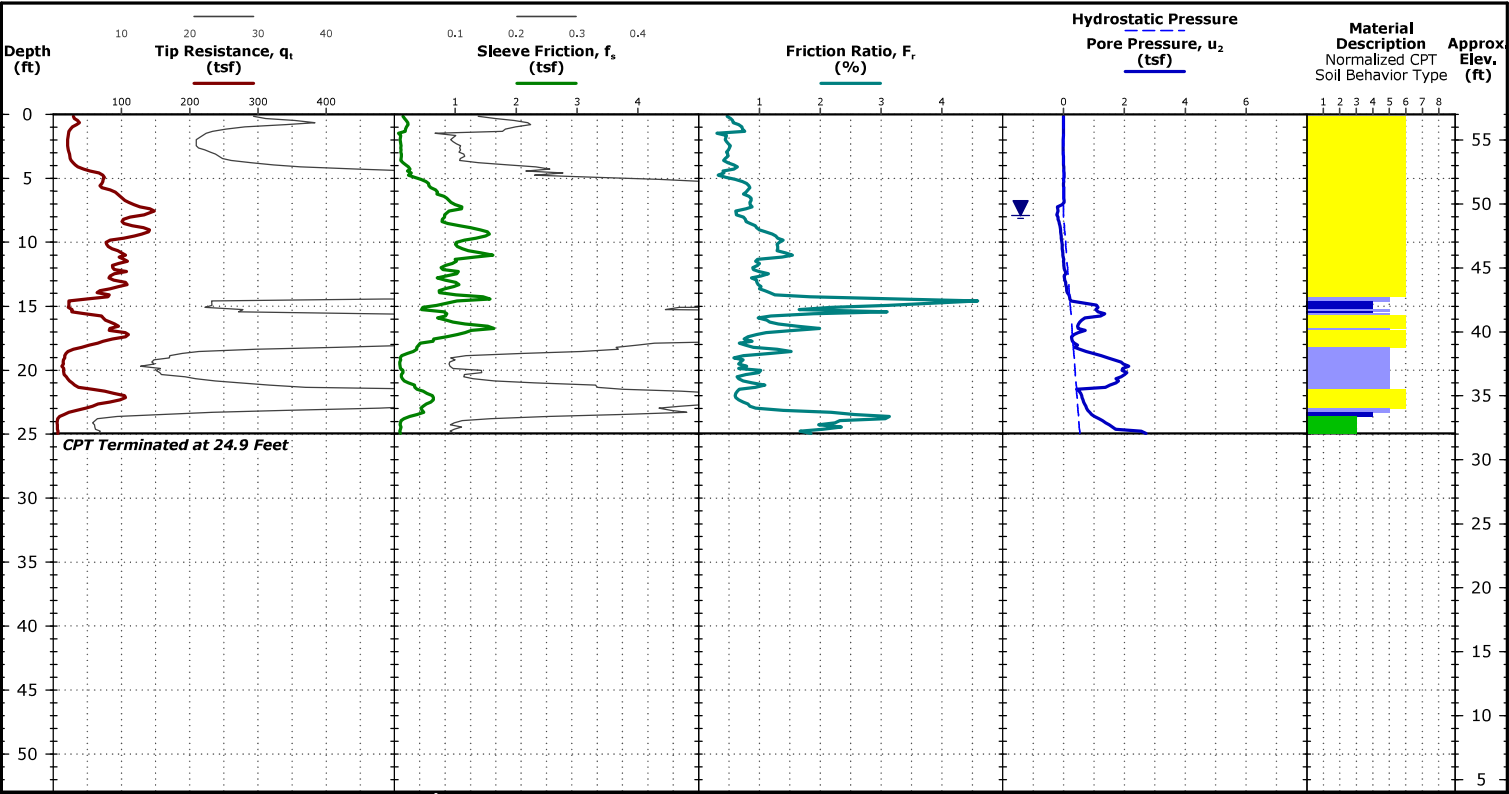
2108 Capital Dr, Ste 103  
Wilmington, NC

Elevation: 57 (ft) +/-

Elevation Reference: Elevations were interpolated from a topographic site plan.

CPT Started: 11/21/2024

CPT Completed: 11/21/2024



See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data, if any.  
See [Supporting Information](#) for explanation of symbols and abbreviations.

### Notes

Test Location: See [Exploration Plan](#)

### CPT Equipment

CPT Rig: MST-300VDL  
Operator: J. Duffy  
CPT sensor calibration reports available upon request  
Probe No. DDG1299 with net area ratio of .8  
U<sub>2</sub> pore pressure transducer location  
Manufactured by Vertek- Calibrated 9/24/2020  
Tip and sleeve areas of 10 cm<sup>2</sup> and 150 cm<sup>2</sup>  
Ring friction reducer with O.D. of 1.8973 in

### Water Level Observation

7.9 ft measured water depth  
(used in normalizations and correlations)

### Normalized Soil Behavior Type (Robertson 1990)

- 1 Sensitive, fine grained
- 2 Organic soils - clay
- 3 Clay - silty clay to clay
- 4 Silt mixtures - clayey silt to silty clay
- 5 Sand mixtures - silty sand to sandy silt
- 6 Sands - clean sand to silty sand
- 7 Gravely sand to dense sand
- 8 Very stiff sand to clayey sand
- 9 Very stiff fine grained

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Terracon Project No. K6245099

## CPT Sounding ID B-05

Latitude: 34.3717° Longitude: -77.7052°

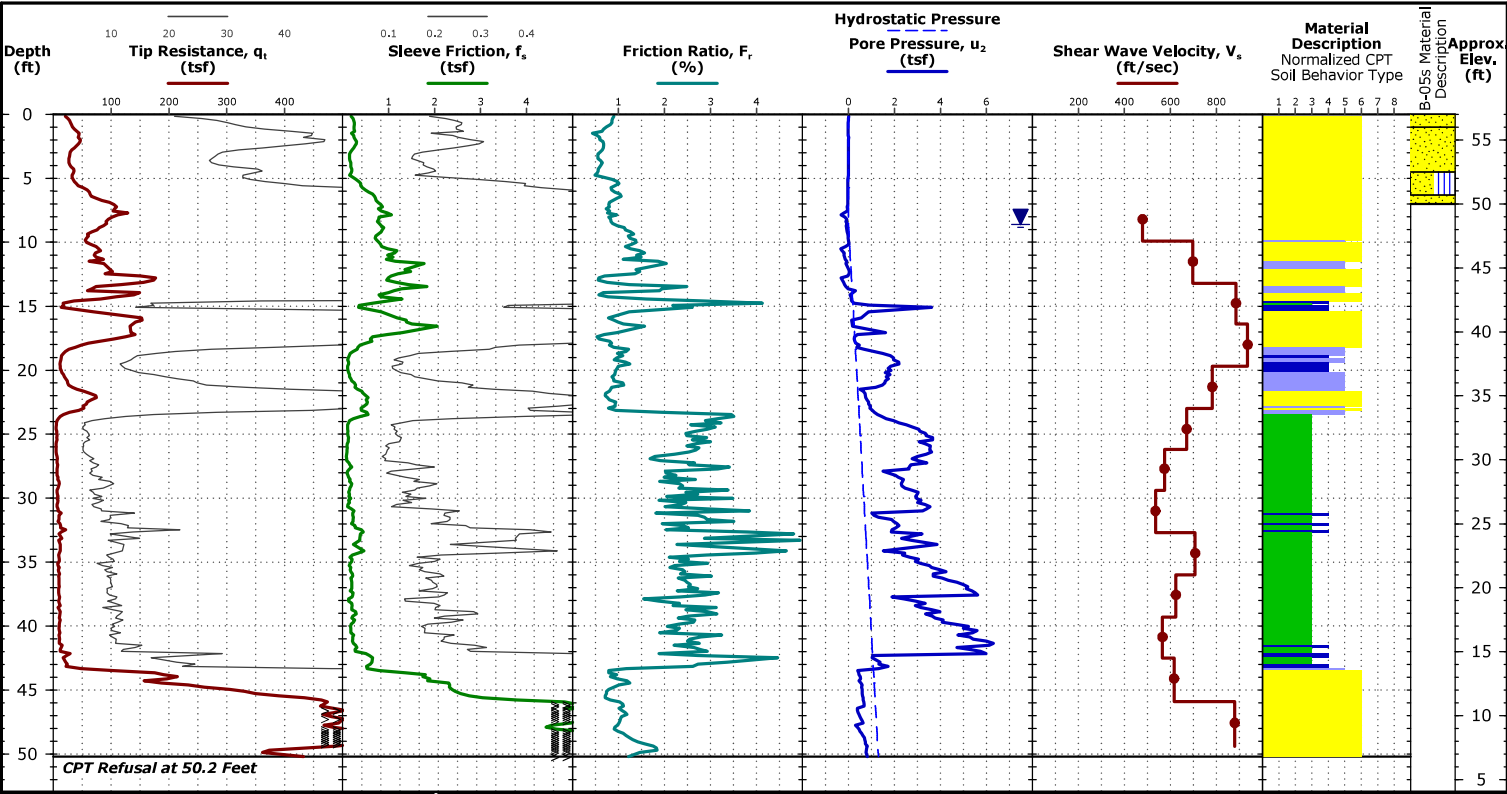


2108 Capital Dr, Ste 103  
Wilmington, NC

Elevation: 57 (ft) +/-

Elevation Reference: Elevations were interpolated from a topographic site plan.

CPT Started: 11/21/2024  
CPT Completed: 11/21/2024



See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data, if any.  
See [Supporting Information](#) for explanation of symbols and abbreviations.

### Notes

Test Location: See [Exploration Plan](#)  
See B-05s for the adjacent test's full details.

### CPT Equipment

CPT Rig: MST-300VDL  
Operator: J. Duffy  
CPT sensor calibration reports available upon request  
Probe No. DDG1299 with net area ratio of .8  
U<sub>2</sub> pore pressure transducer location  
Manufactured by Vertek- Calibrated 9/24/2020  
Tip and sleeve areas of 10 cm<sup>2</sup> and 150 cm<sup>2</sup>  
Ring friction reducer with O.D. of 1.8973 in

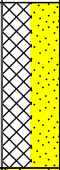


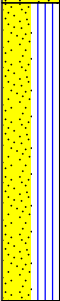

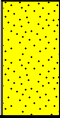
### Water Level Observation

8.6 ft measured water depth  
(used in normalizations and correlations)

### Normalized Soil Behavior Type (Robertson 1990)

- 1 Sensitive, fine grained
- 2 Organic soils - clay
- 3 Clay - silty clay to clay
- 4 Silt mixtures - clayey silt to silty clay
- 5 Sand mixtures - silty sand to sandy silt
- 6 Sands - clean sand to silty sand
- 7 Gravelly sand to dense sand
- 8 Very stiff sand to clayey sand
- 9 Very stiff fine grained

Boring Log No. B-05s

Model Layer	Graphic Log	Location: See <a href="#">Exploration Plan</a> Latitude: 34.3717° Longitude: -77.7052°		Depth (Ft.)	Water Level Observations	Sample Type	Water Content (%)	Atterberg Limits	Percent Fines
		Depth (Ft.)	Elevation: 57 (Ft.) +/-					LL-PL-PI	
1		<b>FILL - POORLY GRADED SAND</b> , fine to medium, gray and white		1.0					
2		<b>POORLY GRADED SAND (SP)</b> , fine to medium, tan and brown		56					
		-Color change to tan		2			3.7		
				3					
				4					
				5					
		<b>POORLY GRADED SAND WITH SILT (SP-SM)</b> , fine to medium, black		52.5					
				5			14.3	NP	7
				6					
		<b>POORLY GRADED SAND (SP)</b> , fine to medium, brown		50.7					
				6.3					
				7					
		<b>Boring Terminated at 7 Feet</b>		50					
				7					

See <a href="#">Exploration and Testing Procedures</a> for a description of field and laboratory procedures used and additional data (If any). See <a href="#">Supporting Information</a> for explanation of symbols and abbreviations. Elevation Reference: Elevations were interpolated from a topographic site plan.	<b>Water Level Observations</b> Groundwater not encountered	<b>Drill Rig</b> N/A
		<b>Hammer Type</b> N/A
		<b>Driller</b> N. Lindley
<b>Notes</b>	<b>Advancement Method</b> Hand Auger	<b>Logged by</b> N. Lindley
		<b>Boring Started</b> 11-26-2024
	<b>Abandonment Method</b> Boring backfilled with soil cuttings upon completion.	<b>Boring Completed</b> 11-26-2024

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## CPT Sounding ID B-06

Latitude: 34,3719° Longitude: -77,7052°

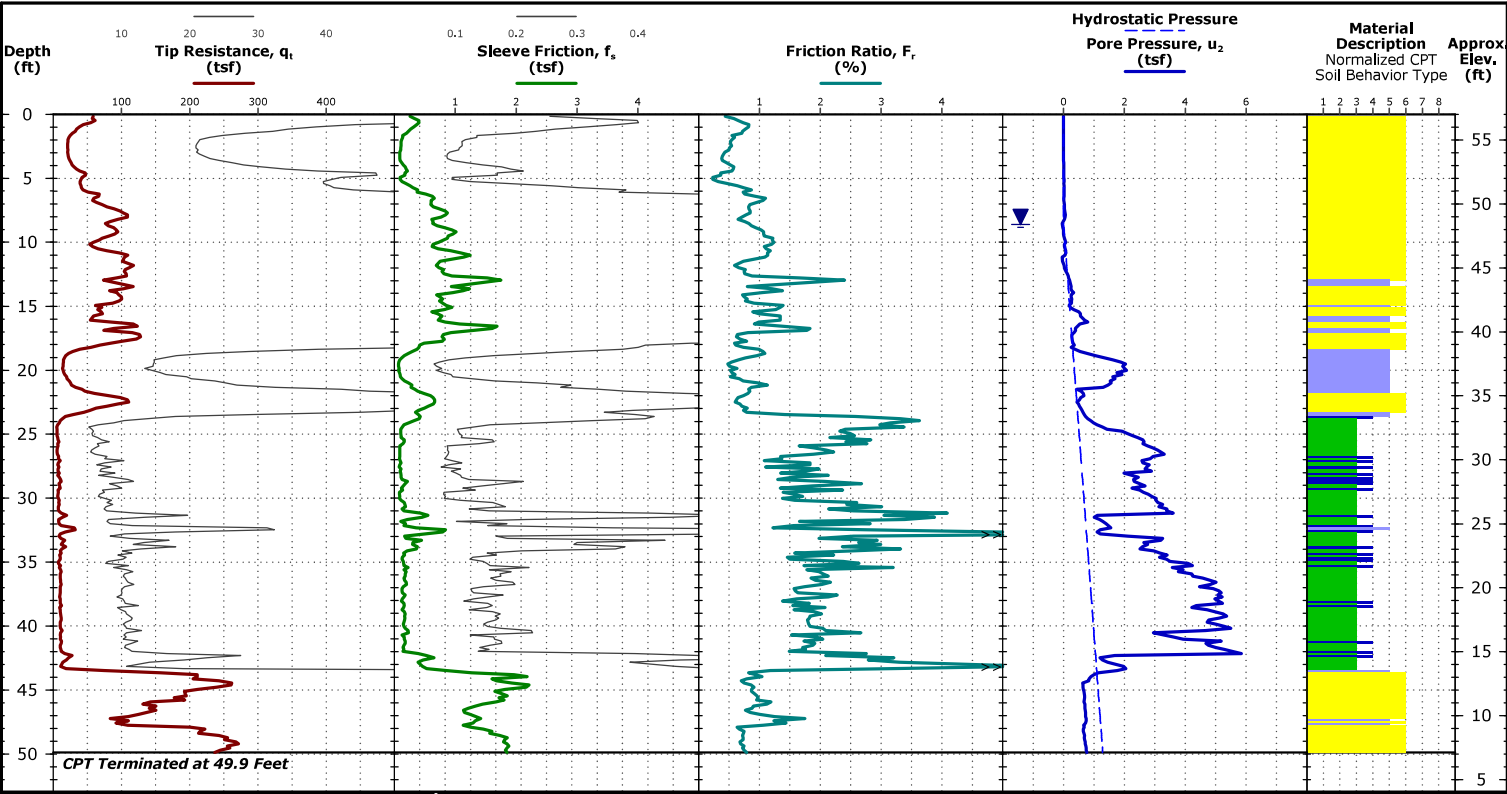


2108 Capital Dr, Ste 103  
Wilmington, NC

Elevation: 57 (ft) +/-

Elevation Reference: Elevations were interpolated from a topographic site plan.

CPT Started: 11/21/2024  
CPT Completed: 11/21/2024



See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data, if any.  
See [Supporting Information](#) for explanation of symbols and abbreviations.

### Notes

Test Location: See [Exploration Plan](#)

### CPT Equipment

CPT Rig: MST-300VDL  
Operator: J. Duffy  
CPT sensor calibration reports available upon request  
Probe No. DDG1299 with net area ratio of .8  
U<sub>2</sub> pore pressure transducer location  
Manufactured by Vertek- Calibrated 9/24/2020  
Tip and sleeve areas of 10 cm<sup>2</sup> and 150 cm<sup>2</sup>  
Ring friction reducer with O.D. of 1.8973 in

### Water Level Observation

▼ 8.6 ft measured water depth  
(used in normalizations and correlations)

### Normalized Soil Behavior Type (Robertson 1990)

- 1 Sensitive, fine grained
- 2 Organic soils - clay
- 3 Clay - silty clay to clay
- 4 Silt mixtures - clayey silt to silty clay
- 5 Sand mixtures - silty sand to sandy silt
- 6 Sands - clean sand to silty sand
- 7 Gravely sand to dense sand
- 8 Very stiff sand to clayey sand
- 9 Very stiff fine grained

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Terracon Project No. K6245099

## CPT Sounding ID B-07

Latitude: 34,3718° Longitude: -77,7050°

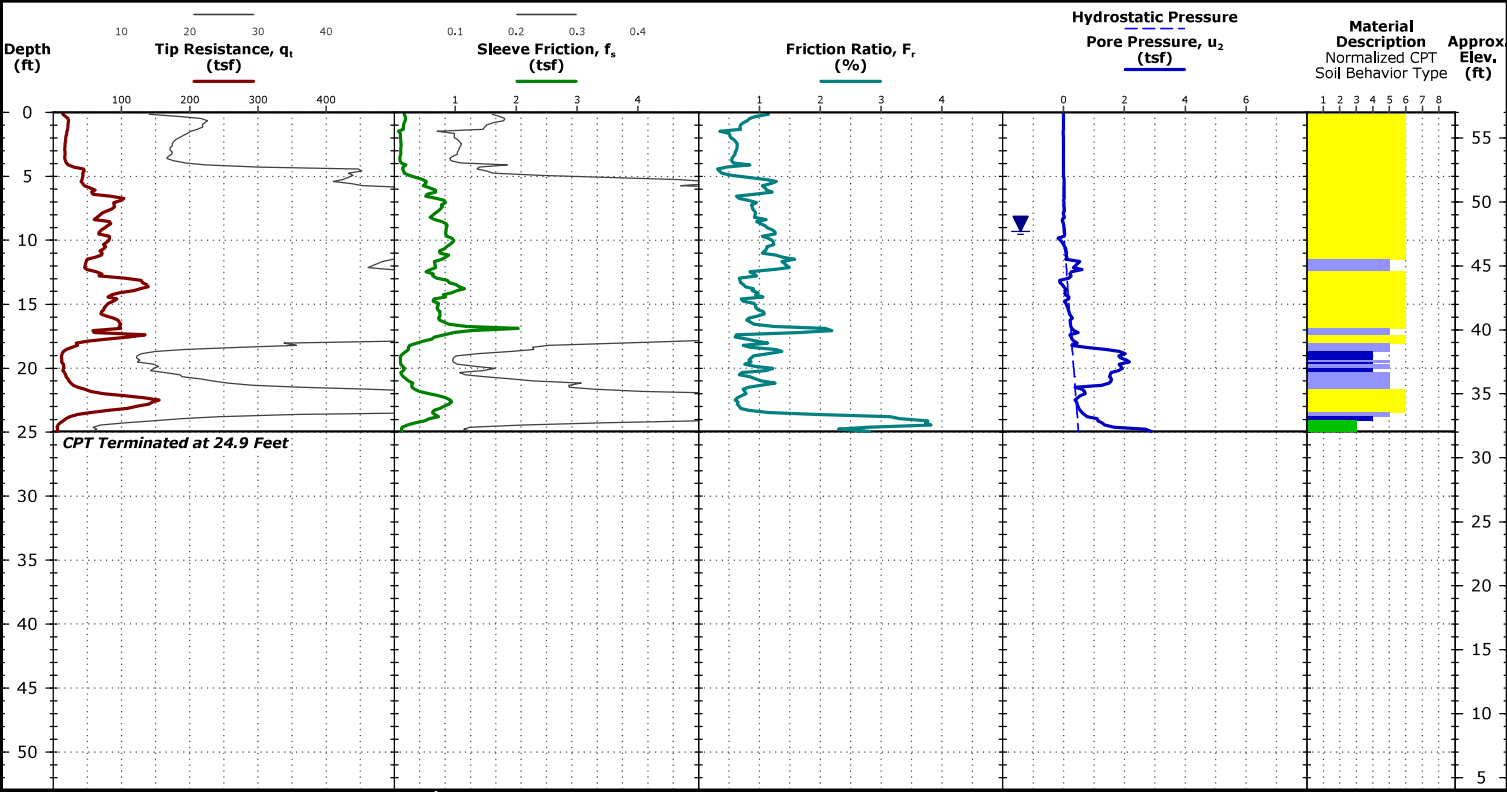


2108 Capital Dr, Ste 103  
Wilmington, NC

Elevation: 57 (ft) +/-

Elevation Reference: Elevations were interpolated from a topographic site plan.

CPT Started: 11/21/2024  
CPT Completed: 11/21/2024



See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data, if any.  
See [Supporting Information](#) for explanation of symbols and abbreviations.

### Notes

Test Location: See [Exploration Plan](#)

### CPT Equipment

CPT Rig: MST-300VDL  
Operator: J. Duffy  
CPT sensor calibration reports available upon request  
Probe No. DDG1299 with net area ratio of .8  
U<sub>2</sub> pore pressure transducer location  
Manufactured by Vertek- Calibrated 9/24/2020  
Tip and sleeve areas of 10 cm<sup>2</sup> and 150 cm<sup>2</sup>  
Ring friction reducer with O.D. of 1.8973 in

### Water Level Observation

▼ 9.3 ft measured water depth  
(used in normalizations and correlations)

### Normalized Soil Behavior Type (Robertson 1990)

- 1 Sensitive, fine grained
- 2 Organic soils - clay
- 3 Clay - silty clay to clay
- 4 Silt mixtures - clayey silt to silty clay
- 5 Sand mixtures - silty sand to sandy silt
- 6 Sands - clean sand to silty sand
- 7 Gravelly sand to dense sand
- 8 Very stiff sand to clayey sand
- 9 Very stiff fine grained

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Terracon Project No. K6245099

## CPT Sounding ID P-01

Latitude: 34.3716° Longitude: -77.7058°

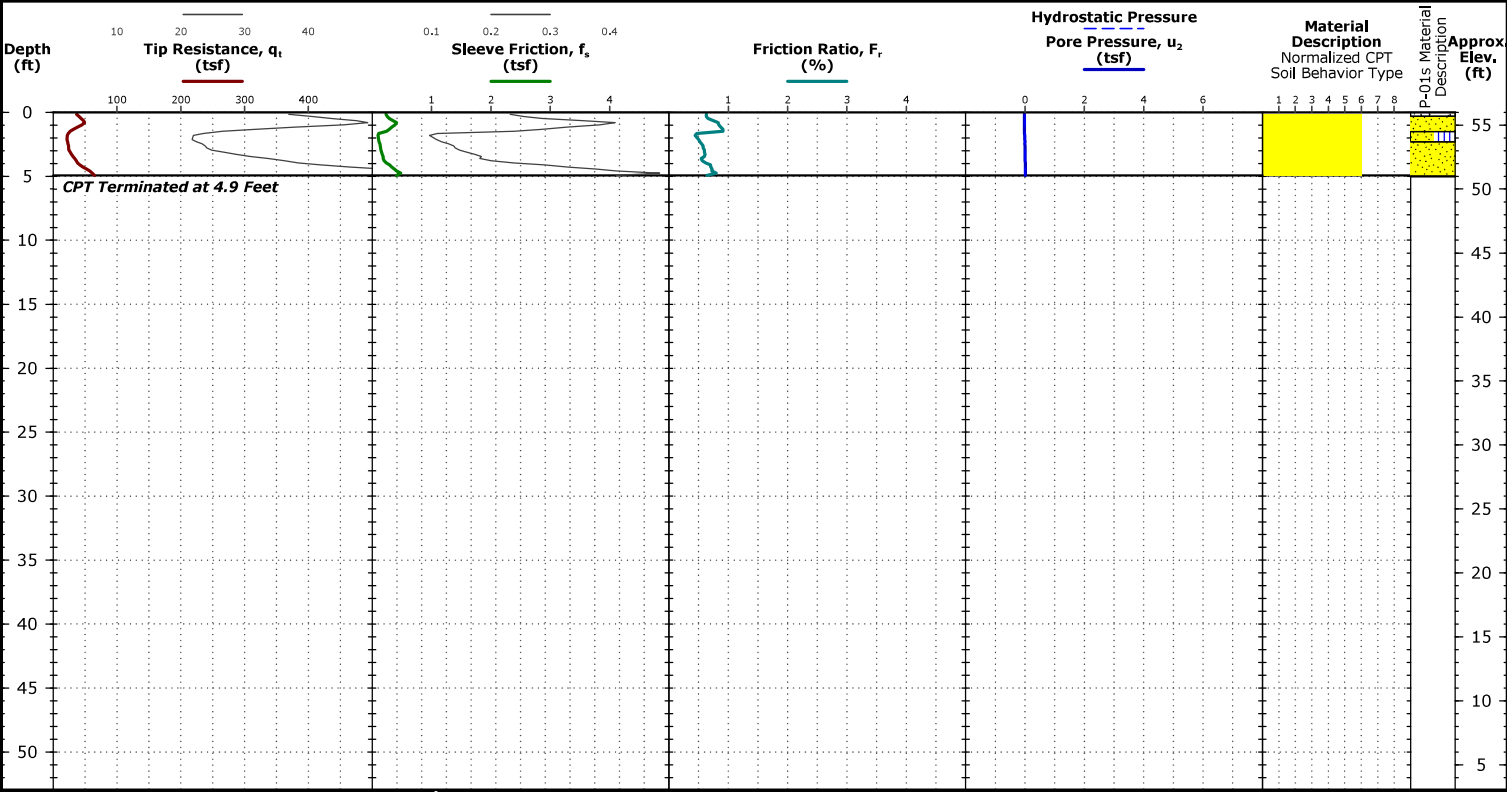


2108 Capital Dr, Ste 103  
Wilmington, NC

Elevation: 56 (ft) +/-

Elevation Reference: Elevations were interpolated from a topographic site plan.

CPT Started: 11/21/2024  
CPT Completed: 11/21/2024



See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data, if any.  
See [Supporting Information](#) for explanation of symbols and abbreviations.

### Notes

Test Location: See [Exploration Plan](#)  
See P-01s for the adjacent test's full details.

### CPT Equipment

CPT Rig: MST-300VDL  
Operator: J. Duffy  
CPT sensor calibration reports available upon request  
Probe No. DDG1299 with net area ratio of .8  
 $u_2$  pore pressure transducer location  
Manufactured by Vertek- Calibrated 9/24/2020  
Tip and sleeve areas of 10 cm<sup>2</sup> and 150 cm<sup>2</sup>  
Ring friction reducer with O.D. of 1.8973 in

### Water Level Observation

Groundwater not observed

### Normalized Soil Behavior Type (Robertson 1990)

- 1 Sensitive, fine grained
- 2 Organic soils - clay
- 3 Clay - silty clay to clay
- 4 Silt mixtures - clayey silt to silty clay
- 5 Sand mixtures - silty sand to sandy silt
- 6 Sands - clean sand to silty sand
- 7 Gravelly sand to dense sand
- 8 Very stiff sand to clayey sand
- 9 Very stiff fine grained

Boring Log No. P-01s

Model Layer	Graphic Log	Location: See <a href="#">Exploration Plan</a> Latitude: 34.3716° Longitude: -77.7058°		Depth (Ft.)	Water Level Observations	Sample Type	Water Content (%)	Atterberg Limits	Percent Fines
								LL-PL-PI	
		Depth (Ft.)	Elevation: 56 (Ft.) +/-						
		<b>TOPSOIL</b> , 3 inches		0.3					
1		<b>FILL - POORLY GRADED SAND</b> , fine to medium, gray and white		55.7					
				1			2.7		
				1.5					
		<b>POORLY GRADED SAND WITH SILT (SP-SM)</b> , fine to coarse, dark brown, with hardpan		54.5					
				2					
				2.3					
		<b>POORLY GRADED SAND (SP)</b> , fine to medium, tan and dark brown		53.7					
2				3					
				4					
				5					
		<b>Boring Terminated at 5 Feet</b>		51					
Notes		See <a href="#">Exploration and Testing Procedures</a> for a description of field and laboratory procedures used and additional data (If any). See <a href="#">Supporting Information</a> for explanation of symbols and abbreviations. Elevation Reference: Elevations were interpolated from a topographic site plan.		Water Level Observations Groundwater not encountered		Drill Rig N/A  Hammer Type N/A  Driller N. Lindley			
		Advancement Method Hand Auger		Abandonment Method Boring backfilled with soil cuttings upon completion.		Logged by N. Lindley  Boring Started 11-26-2024  Boring Completed 11-26-2024			

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Terracon Project No. K6245099

CPT Sounding ID P-02

Latitude: 34,3715° Longitude: -77,7056°

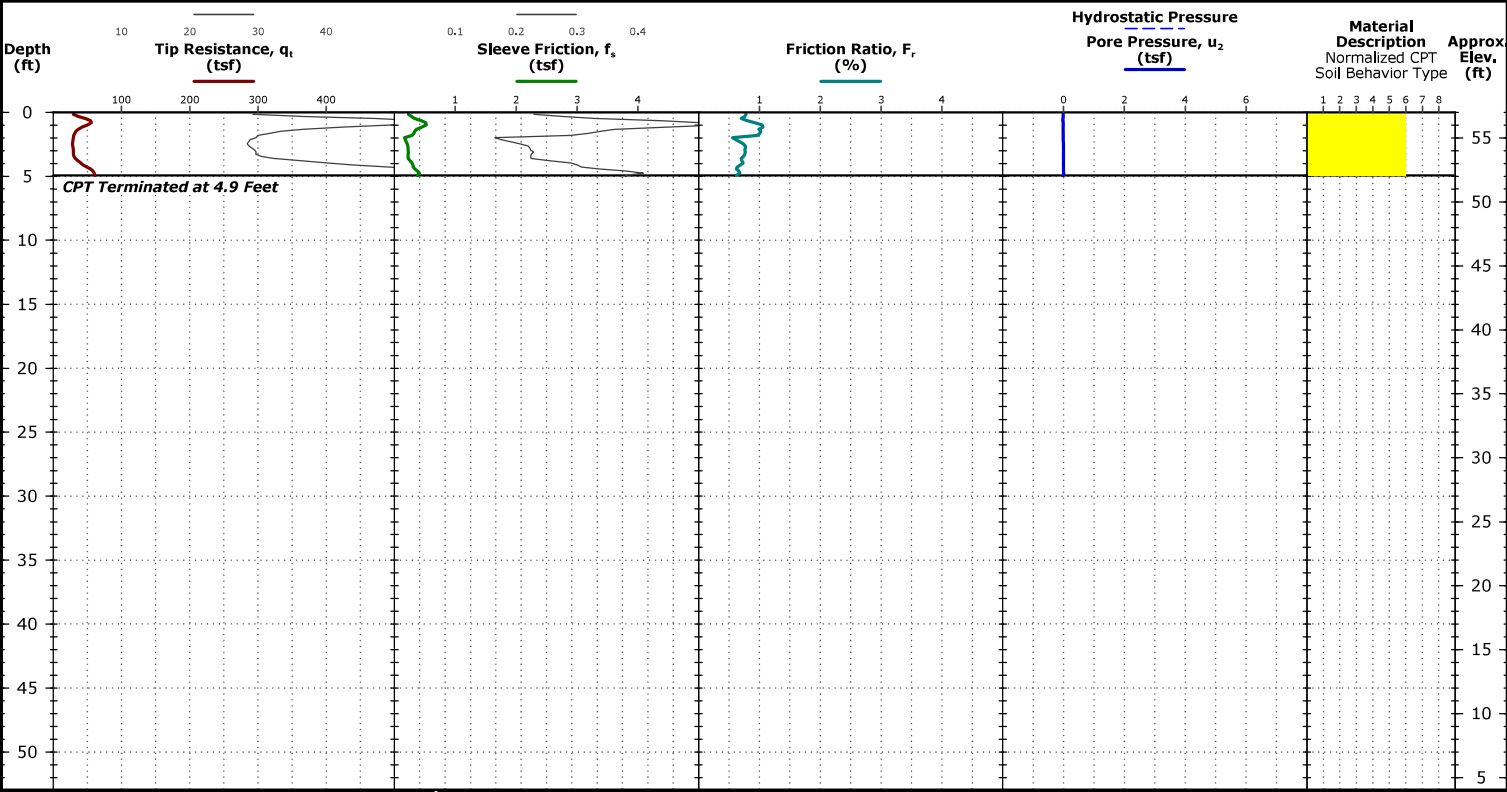


2108 Capital Dr, Ste 103  
Wilmington, NC

Elevation: 57 (ft) +/-

Elevation Reference: Elevations were interpolated from a topographic site plan.

CPT Started: 11/21/2024  
CPT Completed: 11/21/2024



See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data, if any.  
See [Supporting Information](#) for explanation of symbols and abbreviations.

Notes

Test Location: See [Exploration Plan](#)

CPT Equipment

CPT Rig: MST-300VDL  
Operator: J. Duffy  
CPT sensor calibration reports available upon request  
Probe No. DDG1299 with net area ratio of .8  
U<sub>2</sub> pore pressure transducer location  
Manufactured by Vertek- Calibrated 9/24/2020  
Tip and sleeve areas of 10 cm<sup>2</sup> and 150 cm<sup>2</sup>  
Ring friction reducer with O.D. of 1.8973 in

Water Level Observation

Groundwater not observed

Normalized Soil Behavior Type (Robertson 1990)

- 1 Sensitive, fine grained
- 2 Organic soils - clay
- 3 Clay - silty clay to clay
- 4 Silt mixtures - clayey silt to silty clay
- 5 Sand mixtures - silty sand to sandy silt
- 6 Sands - clean sand to silty sand
- 7 Gravelly sand to dense sand
- 8 Very stiff sand to clayey sand
- 9 Very stiff fine grained

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Terracon Project No. K6245099

CPT Sounding ID P-03

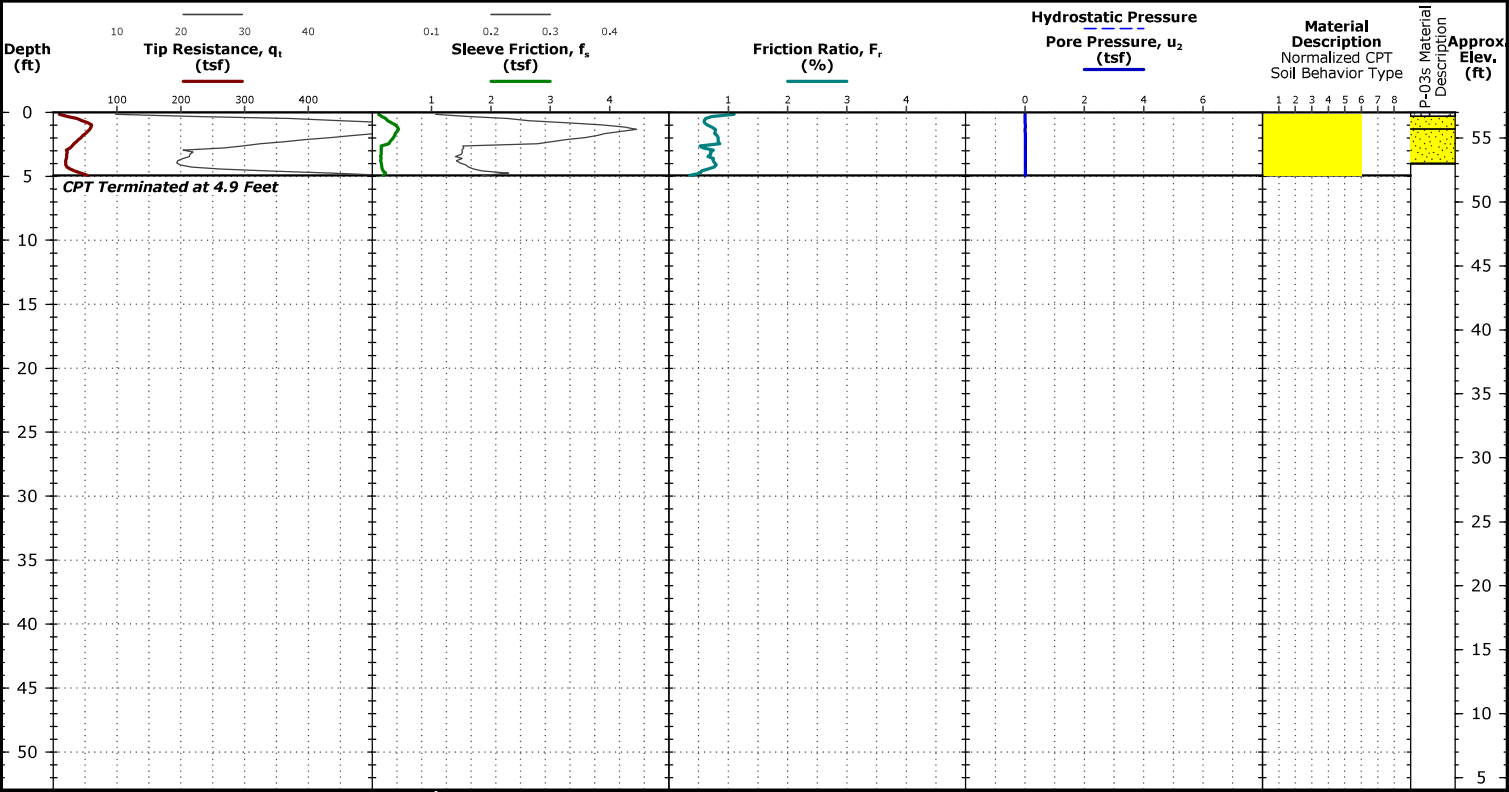
Latitude: 34,3713° Longitude: -77,7054°



2108 Capital Dr, Ste 103  
Wilmington, NC

Elevation: 57 (ft) +/-  
Elevation Reference: Elevations were interpolated from a topographic site plan.

CPT Started: 11/21/2024  
CPT Completed: 11/21/2024



See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data, if any.  
See [Supporting Information](#) for explanation of symbols and abbreviations.




**Notes**  
Test Location: See [Exploration Plan](#)  
See P-03s for the adjacent test's full details.

**CPT Equipment**  
CPT Rig: MST-300VDL  
Operator: J. Duffy  
CPT sensor calibration reports available upon request  
Probe No. DDG1299 with net area ratio of .8  
U<sub>2</sub> pore pressure transducer location  
Manufactured by Vertek- Calibrated 9/24/2020  
Tip and sleeve areas of 10 cm<sup>2</sup> and 150 cm<sup>2</sup>  
Ring friction reducer with O.D. of 1.8973 in

**Water Level Observation**  
Groundwater not observed

**Normalized Soil Behavior Type**  
(Robertson 1990)  
1 Sensitive, fine grained  
2 Organic soils - clay  
3 Clay - silty clay to clay  
4 Silt mixtures - clayey silt to silty clay  
5 Sand mixtures - silty sand to sandy silt  
6 Sands - clean sand to silty sand  
7 Gravelly sand to dense sand  
8 Very stiff sand to clayey sand  
9 Very stiff fine grained

Boring Log No. P-03s

Model Layer	Graphic Log	Location: See <a href="#">Exploration Plan</a> Latitude: 34.3713° Longitude: -77.7054°		Depth (Ft.)	Water Level Observations	Sample Type	Water Content (%)	Atterberg Limits	Percent Fines
								LL-PL-PI	
		Depth (Ft.)	Elevation: 57 (Ft.) +/-						
		<b>TOPSOIL</b> , 3 inches		0.3	56.7				
1		<b>FILL - POORLY GRADED SAND</b> , fine to medium, gray and white		1.3	55.7				
2		<b>POORLY GRADED SAND (SP)</b> , fine to medium, brown and tan		4.0	53			NP	4
		<b>Boring Terminated at 4 Feet</b>							

Notes	See <a href="#">Exploration and Testing Procedures</a> for a description of field and laboratory procedures used and additional data (If any).	Water Level Observations Groundwater not encountered	Drill Rig N/A
	See <a href="#">Supporting Information</a> for explanation of symbols and abbreviations. Elevation Reference: Elevations were interpolated from a topographic site plan.		
	Advancement Method Hand Auger	Boring Started 11-26-2024	Boring Completed 11-26-2024
	Abandonment Method Boring backfilled with soil cuttings upon completion.		

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Terracon Project No. K6245099

CPT Sounding ID P-04

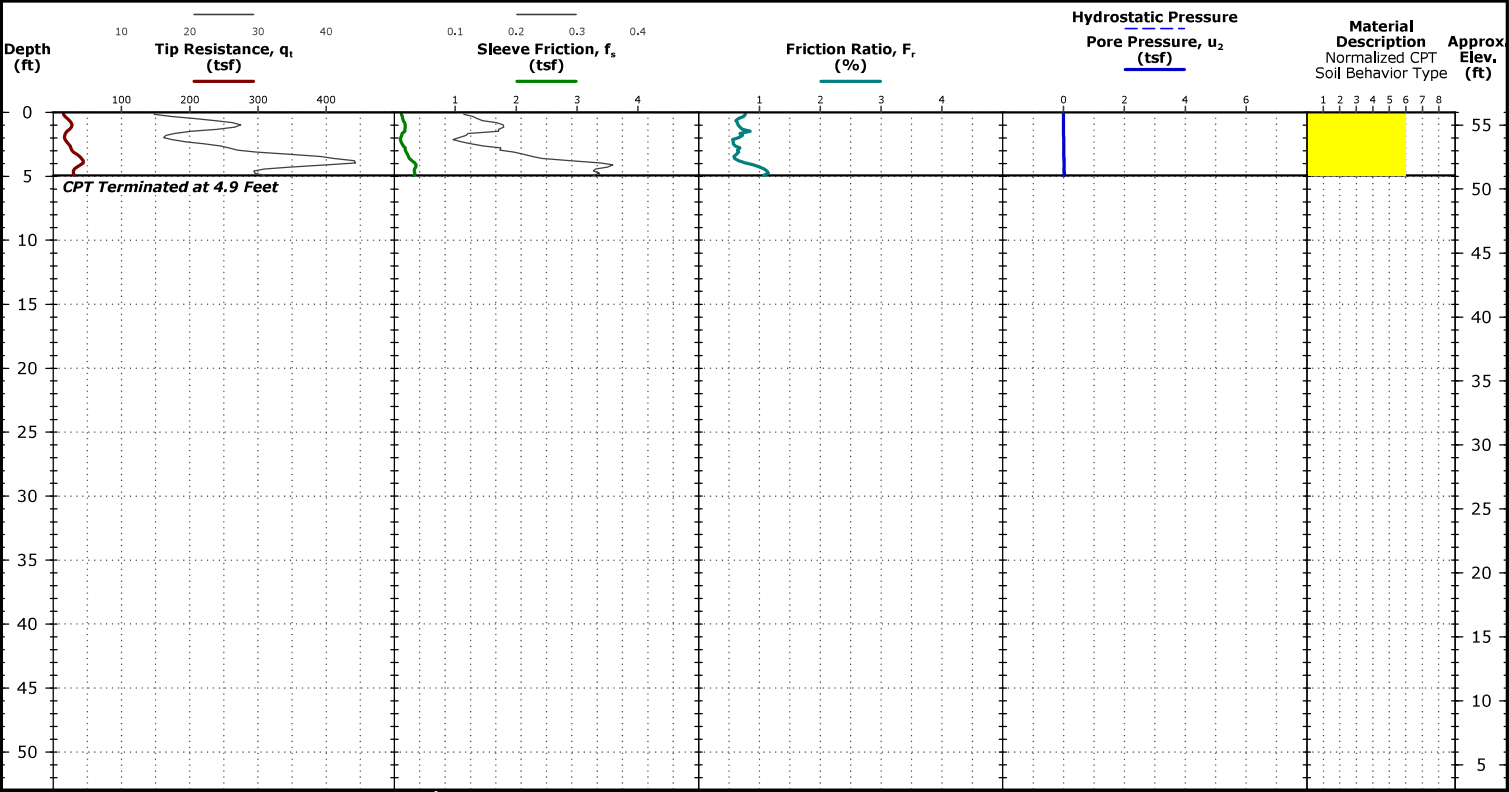


2108 Capital Dr, Ste 103  
Wilmington, NC

Elevation: 56 (ft) +/-  
Elevation Reference: Elevations were interpolated from a topographic site plan.

Latitude: 34,3718° Longitude: -77,7056°

CPT Started: 11/21/2024  
CPT Completed: 11/21/2024



See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data, if any.  
See [Supporting Information](#) for explanation of symbols and abbreviations.

**Notes**  
Test Location: See [Exploration Plan](#)

**CPT Equipment**  
CPT Rig: MST-300VDL  
Operator: J. Duffy  
CPT sensor calibration reports available upon request  
Probe No. DDG1299 with net area ratio of .8  
U<sub>2</sub> pore pressure transducer location  
Manufactured by Vertek- Calibrated 9/24/2020  
Tip and sleeve areas of 10 cm<sup>2</sup> and 150 cm<sup>2</sup>  
Ring friction reducer with O.D. of 1.8973 in

**Water Level Observation**  
Groundwater not observed

**Normalized Soil Behavior Type (Robertson 1990)**  
1 Sensitive, fine grained  
2 Organic soils - clay  
3 Clay - silty clay to clay  
4 Silt mixtures - clayey silt to silty clay  
5 Sand mixtures - silty sand to sandy silt  
6 Sands - clean sand to silty sand  
7 Gravely sand to dense sand  
8 Very stiff sand to clayey sand  
9 Very stiff fine grained

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Terracon Project No. K6245099

CPT Sounding ID P-05

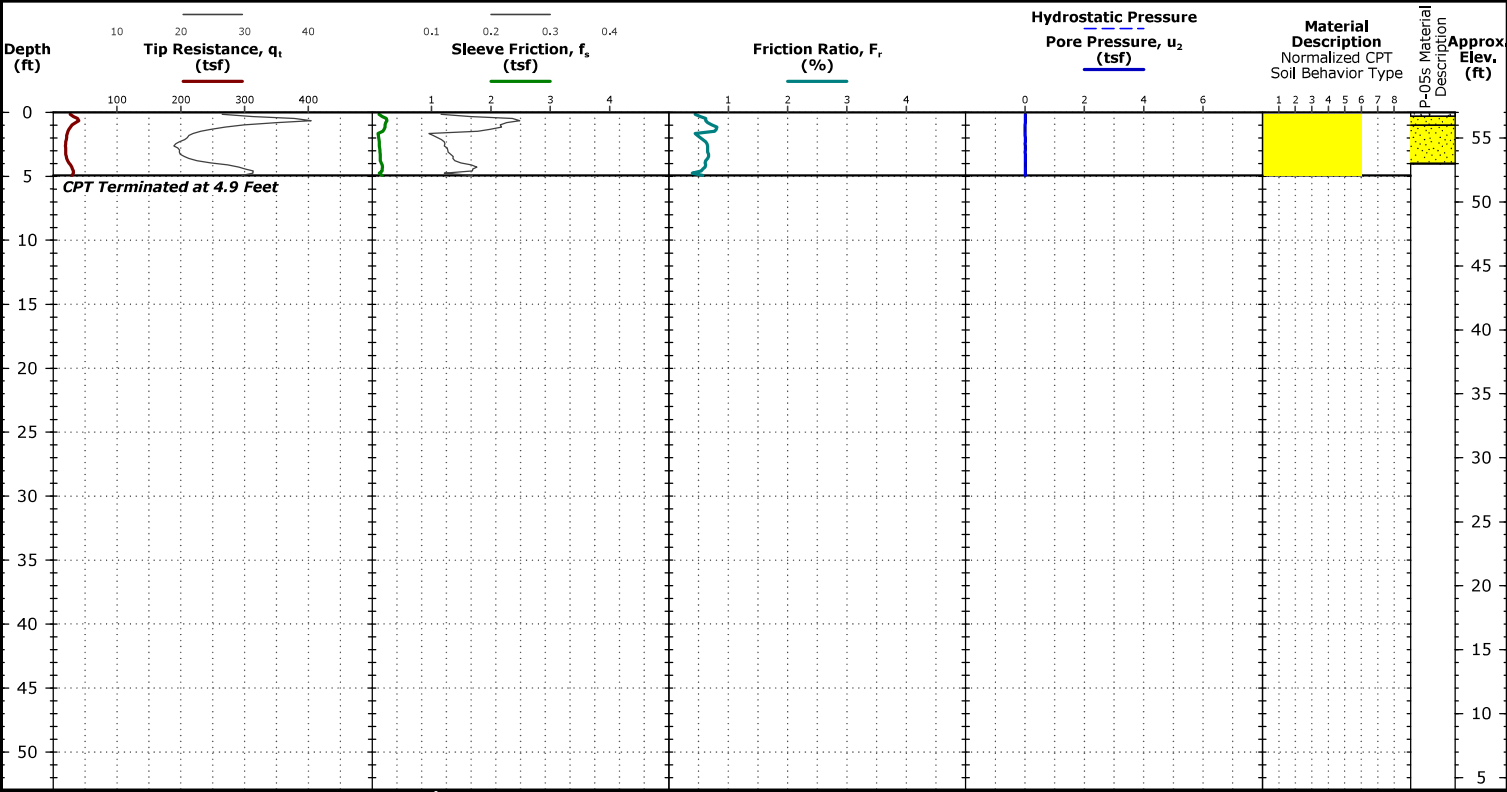


2108 Capital Dr, Ste 103  
Wilmington, NC

Elevation: 57 (ft) +/-  
Elevation Reference: Elevations were interpolated from a topographic site plan.

Latitude: 34,3717° Longitude: -77,7054°

CPT Started: 11/21/2024  
CPT Completed: 11/21/2024



See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data, if any.  
See [Supporting Information](#) for explanation of symbols and abbreviations.






**Notes**  
Test Location: See [Exploration Plan](#)  
See P-05s for the adjacent test's full details.

**CPT Equipment**  
CPT Rig: MST-300VDL  
Operator: J. Duffy  
CPT sensor calibration reports available upon request  
Probe No. DDG1299 with net area ratio of .8  
U<sub>2</sub> pore pressure transducer location  
Manufactured by Vertek- Calibrated 9/24/2020  
Tip and sleeve areas of 10 cm<sup>2</sup> and 150 cm<sup>2</sup>  
Ring friction reducer with O.D. of 1.8973 in

**Water Level Observation**  
Groundwater not observed

**Normalized Soil Behavior Type**  
(Robertson 1990)  
1 Sensitive, fine grained  
2 Organic soils - clay  
3 Clay - silty clay to clay  
4 Silt mixtures - clayey silt to silty clay  
5 Sand mixtures - silty sand to sandy silt  
6 Sands - clean sand to silty sand  
7 Gravelly sand to dense sand  
8 Very stiff sand to clayey sand  
9 Very stiff fine grained

Boring Log No. P-05s

Model Layer	Graphic Log	Location: See <a href="#">Exploration Plan</a> Latitude: 34.3717° Longitude: -77.7054°  Depth (Ft.)  Elevation: 57 (Ft.) +/-	Depth (Ft.)	Water Level Observations	Sample Type	Water Content (%)	Atterberg Limits	Percent Fines
							LL-PL-PI	
		<b>TOPSOIL</b> , 4 inches 0.3 56.7						
1		<b>FILL - POORLY GRADED SAND</b> , fine to medium, gray and white 1.0 56	1					
		<b>POORLY GRADED SAND (SP)</b> , fine to medium, brown and tan				3.3		
2		-Color change to tan 4.0 53	2 3 4					
		<b>Boring Terminated at 4 Feet</b>				3.4		
See <a href="#">Exploration and Testing Procedures</a> for a description of field and laboratory procedures used and additional data (If any). See <a href="#">Supporting Information</a> for explanation of symbols and abbreviations. Elevation Reference: Elevations were interpolated from a topographic site plan.			<b>Water Level Observations</b> Groundwater not encountered			<b>Drill Rig</b> N/A  <b>Hammer Type</b> N/A  <b>Driller</b> N. Lindley		
<b>Notes</b>			<b>Advancement Method</b> Hand Auger			<b>Logged by</b> N. Lindley		
			<b>Abandonment Method</b> Boring backfilled with soil cuttings upon completion.			<b>Boring Started</b> 11-26-2024  <b>Boring Completed</b> 11-26-2024		

Hampstead Library  
15060 US-17 | Hampstead, NC  
Terracon Project No. K6245099

CPT Sounding ID P-06

Latitude: 34.3715° Longitude: -77.7053°

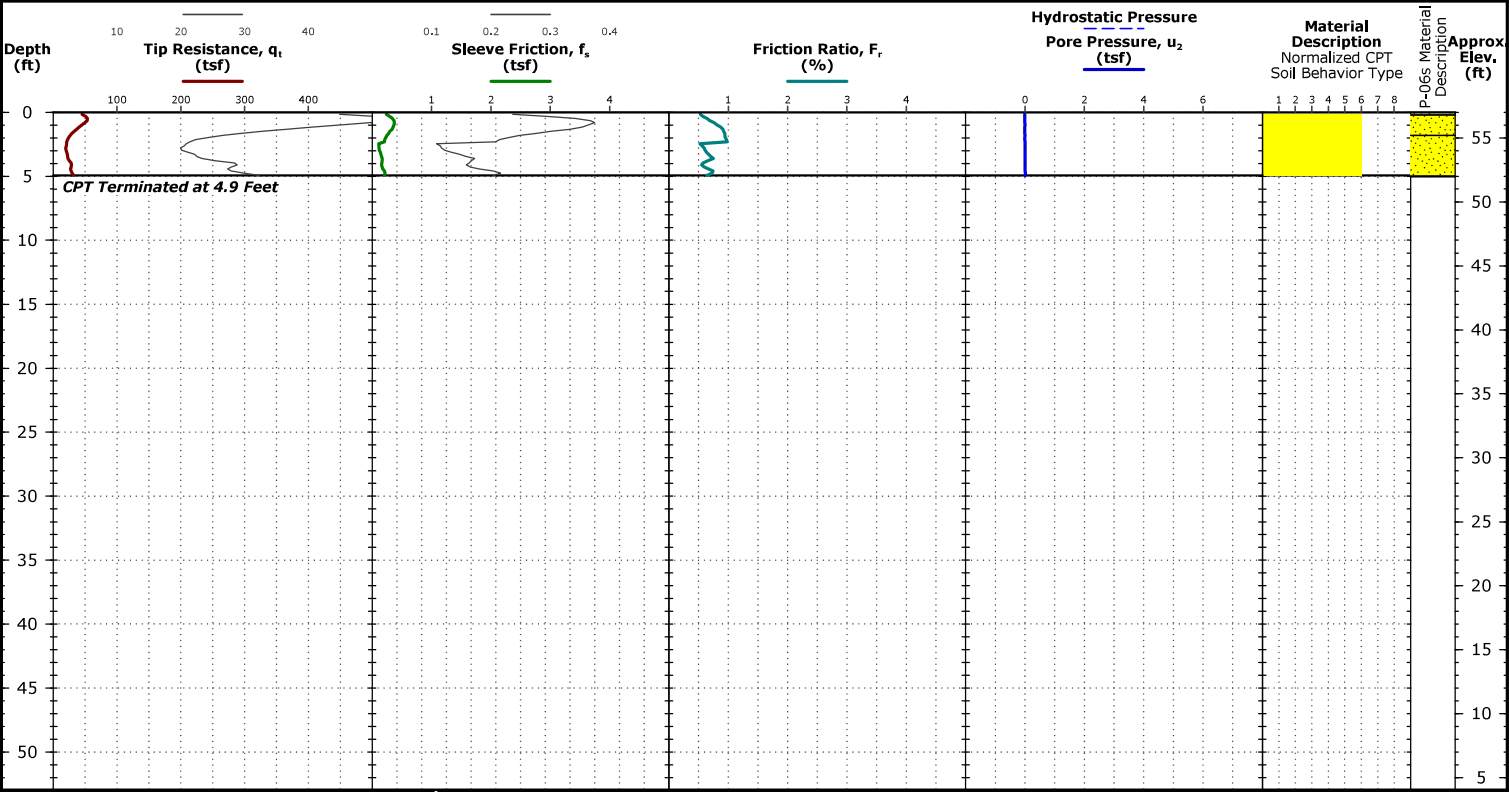


2108 Capital Dr, Ste 103  
Wilmington, NC

Elevation: 57 (ft) +/-

Elevation Reference: Elevations were interpolated from a topographic site plan.

CPT Started: 11/21/2024  
CPT Completed: 11/21/2024



See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data, if any.  
See [Supporting Information](#) for explanation of symbols and abbreviations.

Notes

Test Location: See [Exploration Plan](#)  
See P-06s for the adjacent test's full details.

CPT Equipment

CPT Rig: MST-300VDL  
Operator: J. Duffy  
CPT sensor calibration reports available upon request  
Probe No. DDG1299 with net area ratio of .8  
U<sub>2</sub> pore pressure transducer location  
Manufactured by Vertek- Calibrated 9/24/2020  
Tip and sleeve areas of 10 cm<sup>2</sup> and 150 cm<sup>2</sup>  
Ring friction reducer with O.D. of 1.8973 in


Water Level Observation

Groundwater not observed

Normalized Soil Behavior Type (Robertson 1990)

- 1 Sensitive, fine grained
- 2 Organic soils - clay
- 3 Clay - silty clay to clay
- 4 Silt mixtures - clayey silt to silty clay
- 5 Sand mixtures - silty sand to sandy silt
- 6 Sands - clean sand to silty sand
- 7 Gravelly sand to dense sand
- 8 Very stiff sand to clayey sand
- 9 Very stiff fine grained

Boring Log No. P-06s

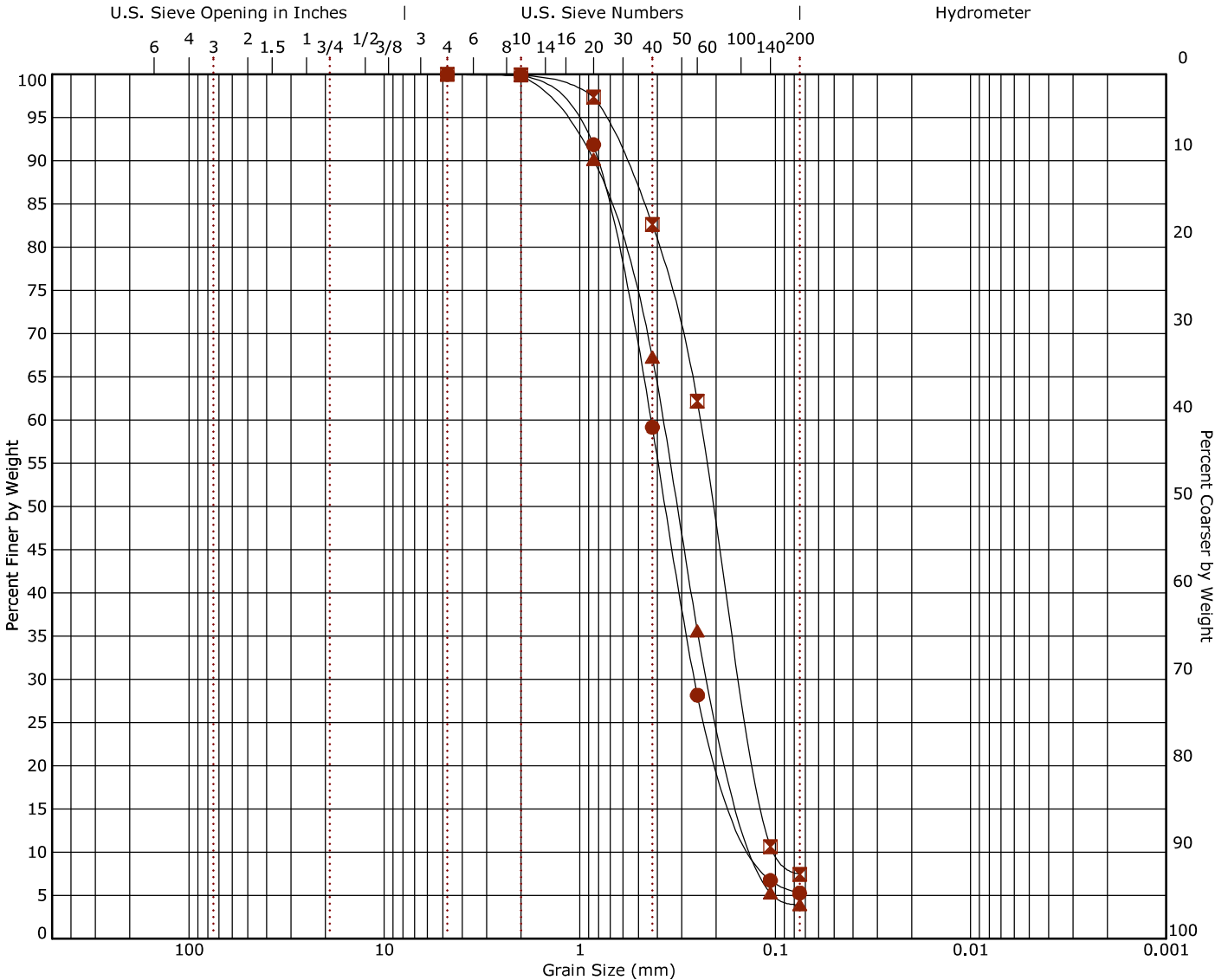
Model Layer	Graphic Log	Location: See <span>Exploration Plan</span>		Depth (Ft.)	Water Level Observations	Sample Type	Water Content (%)	Atterberg Limits	Percent Fines
		Latitude: 34.3715° Longitude: -77.7053°						LL-PL-PI	
		Depth (Ft.)	Elevation: 57 (Ft.) +/-						
		0.2	<b>TOPSOIL</b> , 2 inches	56.8					
1			<b>FILL - POORLY GRADED SAND</b> , fine to medium, gray and white						
		1.8		55.2					
2			<b>POORLY GRADED SAND (SP)</b> , fine to medium, brown and tan						
			-Color change to tan						
		5.0		52					
		<b>Boring Terminated at 5 Feet</b>		5					
See <span>Exploration and Testing Procedures</span> for a description of field and laboratory procedures used and additional data (If any). See <span>Supporting Information</span> for explanation of symbols and abbreviations. Elevation Reference: Elevations were interpolated from a topographic site plan.				<b>Water Level Observations</b> Groundwater not encountered				<b>Drill Rig</b> N/A	
<b>Notes</b>				<b>Advancement Method</b> Hand Auger				<b>Hammer Type</b> N/A	
				<b>Abandonment Method</b> Boring backfilled with soil cuttings upon completion.				<b>Driller</b> N. Lindley	
								<b>Logged by</b> N. Lindley	
								<b>Boring Started</b> 11-26-2024	
								<b>Boring Completed</b> 11-26-2024	



## Summary of Laboratory Results

[illegible]

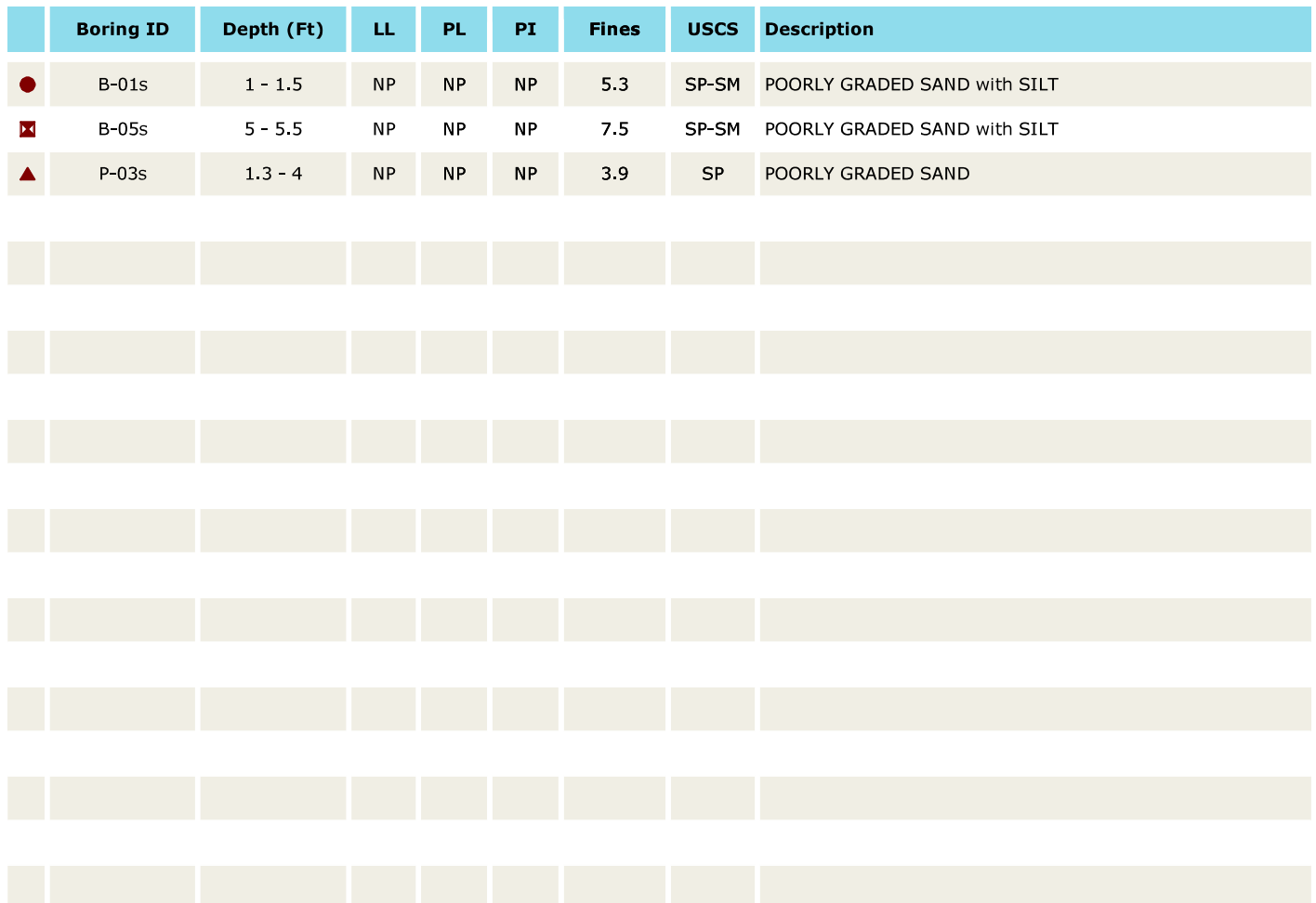
**Grain Size Distribution**  
**ASTM D422 / ASTM C136 / AASHTO T27**



		Gravel		Sand			Silt or Clay	
Cobbles		coarse	fine	coarse	medium	fine		
Boring ID	Depth	% Cobbles	% Gravel	% Sand	% Fines	% Silt	% Clay	USCS
● B-01s	1 - 1.5	0.0	0.0	94.7	5.3			SP-SM
☒ B-05s	5 - 5.5	0.0	0.0	92.5	7.5			SP-SM
▲ P-03s	1.3 - 4	0.0	0.0	96.1	3.9			SP

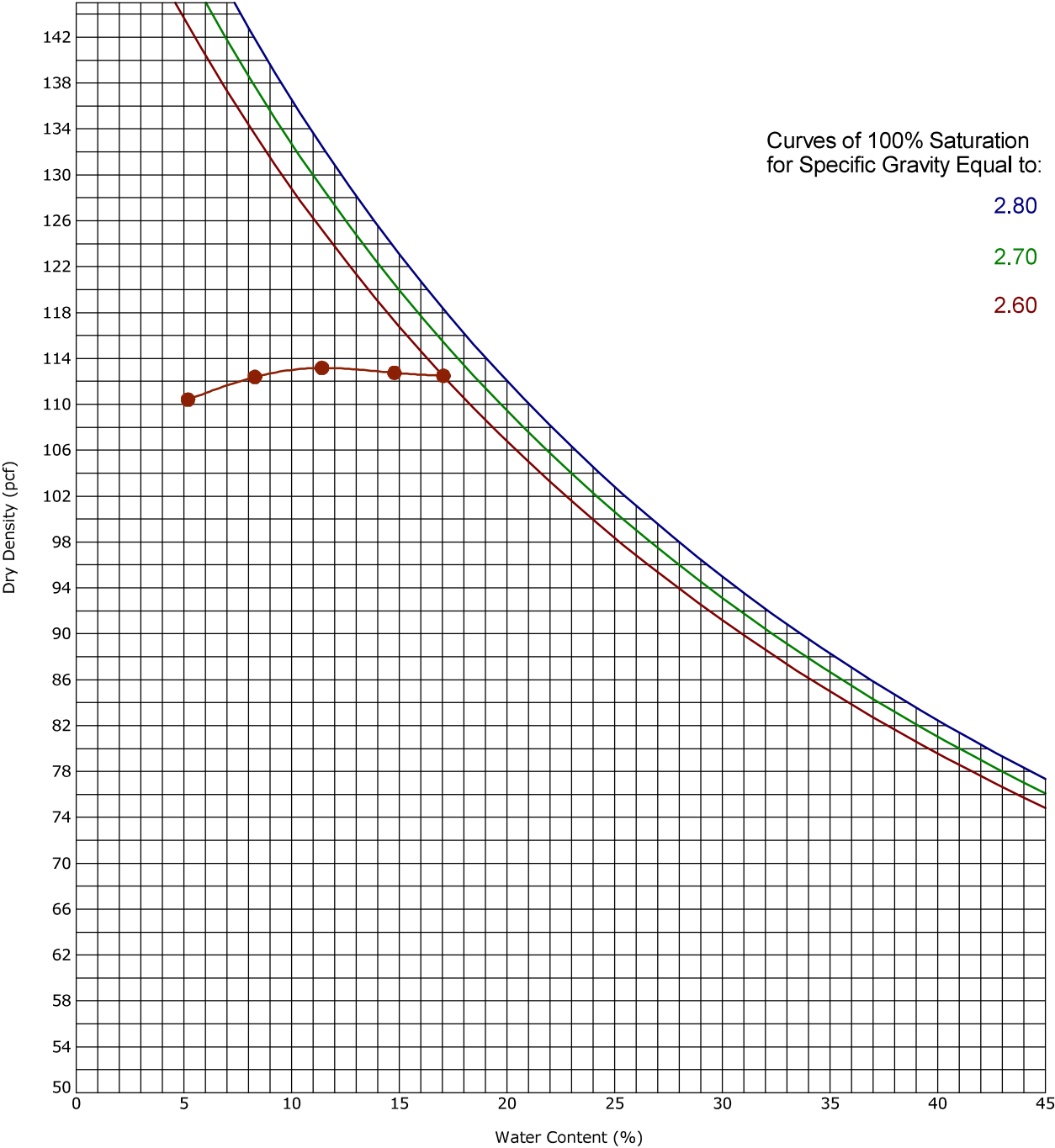
Description		●	☒	▲	Grain Size			
		Sieve	% Finer	Sieve	% Finer	Sieve	% Finer	
● POORLY GRADED SAND with SILT		#4	100.0	#4	100.0	#4	100.0	
☒ POORLY GRADED SAND with SILT		#10	99.92	#10	99.91	#10	99.81	D <sub>60</sub> 0.433 0.241 0.376
▲ POORLY GRADED SAND		#20	91.86	#20	97.36	#20	90.15	
		#40	59.16	#40	82.62	#40	67.28	
		#60	28.16	#60	62.19	#60	35.62	D <sub>10</sub> 0.121 0.099 0.121
		#140	6.73	#140	10.63	#140	5.29	
		#200	5.27	#200	7.46	#200	3.91	
Remarks								Coefficients
		●	☒	▲				
●		C <sub>c</sub>	1.27	0.90	1.00			
☒		C <sub>u</sub>	3.58	2.44	3.11			
▲								

## ASTM D4318



# Moisture-Density Relationship

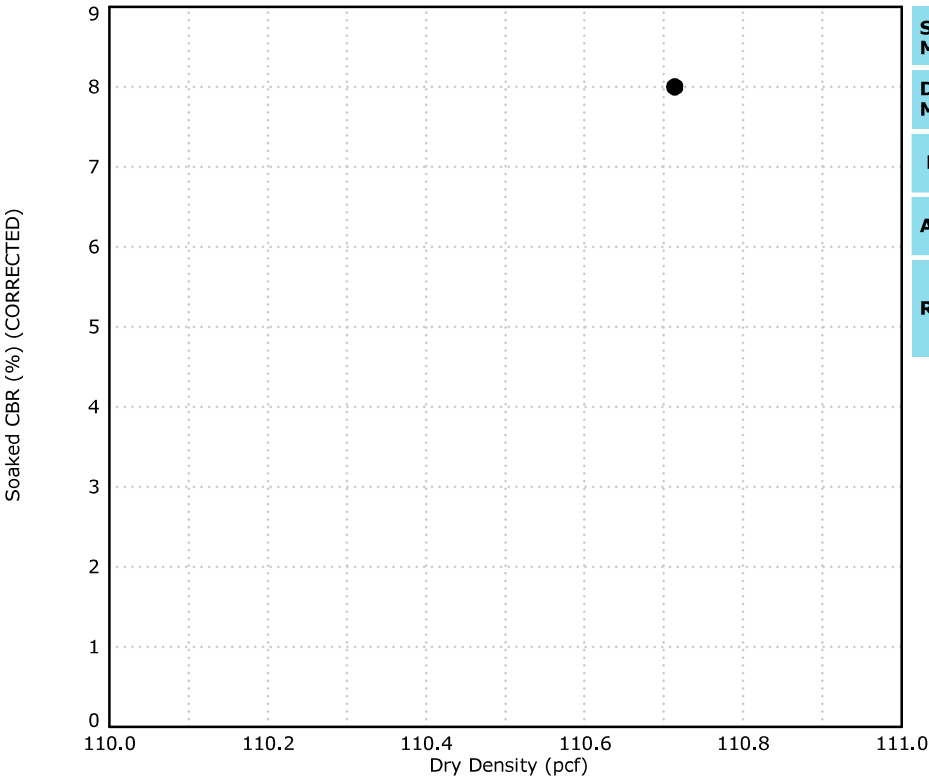
## ASTM D698-Method A



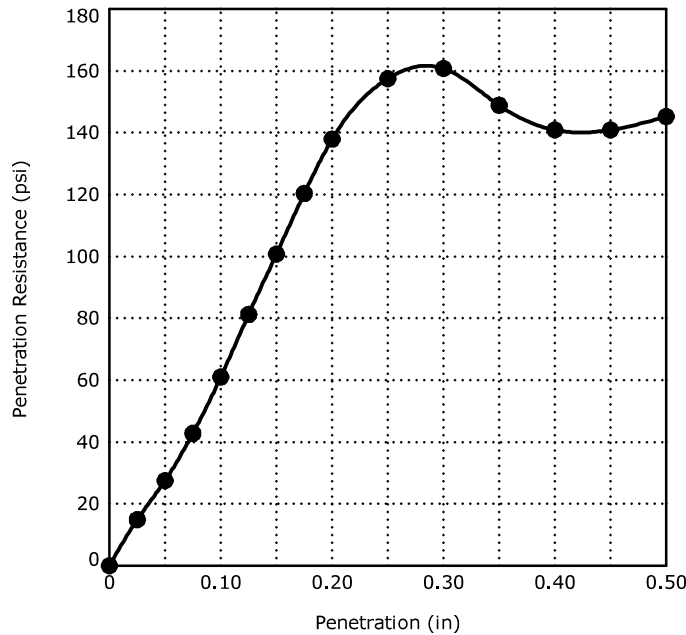
Boring ID		Depth (Ft)		Description of Materials			
P-03s		1.3 - 4		POORLY GRADED SAND(SP)			
Fines (%)	Fraction >4.75 mm size	LL	PL	PI	Test Method	Maximum Dry Density (pcf)	Optimum Water Content (%)
4	0.0	NP	NP	NP	ASTM D698-Method A	113.2	11.6

# California Bearing Ratio

ASTM D1883-07<sup>2</sup>



Source of Material	P-03s 1.3 - 4.0		
Description of Material	POORLY GRADED SAND(SP)		
Percent Fines	3.9		
Atterberg Limits	$\frac{LL}{NP}$	$\frac{PL}{NP}$	$\frac{PI}{NP}$
Remarks:	Corrected CBR value reported due to concave upward shape		



Sample No.	1
Sample Condition	Soaked
Compaction Method	ASTM 698A
Maximum Dry Density, (pcf)	113.2
Optimum Moisture Content, (%)	11.6
Dry Density before Soaking, (pcf)	110.71
Moisture Content, (%)	
After Compaction	12.0
Top 1" After Soaking	14.0
Surcharge, (lbs)	10.00
Swell, (%)	-0.11
Bearing Ratio, (%)	8.0






## Supporting Information

### **Contents:**

General Notes  
CPT General Notes  
Unified Soil Classification System  
Stormwater Soil Evaluations Report

Note: All attachments are one page unless noted above.

## General Notes

Sampling	Water Level	Field Tests
 Grab Sample	 Water Initially Encountered  Water Level After a Specified Period of Time  Water Level After a Specified Period of Time  Cave In Encountered <p>Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.</p>	N Standard Penetration Test Resistance (Blows/Ft.) (HP) Hand Penetrometer (T) Torvane (DCP) Dynamic Cone Penetrometer UC Unconfined Compressive Strength (PID) Photo-Ionization Detector (OVA) Organic Vapor Analyzer

### Descriptive Soil Classification

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

### Location And Elevation Notes

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

### Strength Terms

Relative Density of Coarse-Grained Soils (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		Consistency of Fine-Grained Soils (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Relative Density	Standard Penetration or N-Value (Blows/Ft.)	Consistency	Unconfined Compressive Strength Qu (tsf)	Standard Penetration or N-Value (Blows/Ft.)
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

### Relevance of Exploration and Laboratory Test Results

Exploration/field results and/or laboratory test data contained within this document are intended for application to the project as described in this document. Use of such exploration/field results and/or laboratory test data should not be used independently of this document.

# CPT GENERAL NOTES



## DESCRIPTION OF MEASUREMENTS AND CALIBRATIONS

### To be reported per ASTM D5778:

- Uncorrected Tip Resistance,  $q_c$   
Measured force acting on the cone divided by the cone's projected area
  - Corrected Tip Resistance,  $q_t$   
Cone resistance corrected for porewater and net area ratio effects  
 $q_t = q_c + u_2(1 - a)$   
Where  $a$  is the net area ratio, a lab calibration of the cone typically between 0.70 and 0.85
  - Pore Pressure,  $u$   
Pore pressure measured during penetration  
 $u_1$  - sensor on the face of the cone  
 $u_2$  - sensor on the shoulder (more common)
  - Sleeve Friction,  $f_s$   
Frictional force acting on the sleeve divided by its surface area
  - Normalized Friction Ratio,  $F_r$   
The ratio as a percentage of  $f_s$  to  $q_t$ , accounting for overburden pressure
- To be reported per ASTM D7400, if collected:
- Shear Wave Velocity,  $V_s$   
Measured in a Seismic CPT and provides direct measure of soil stiffness

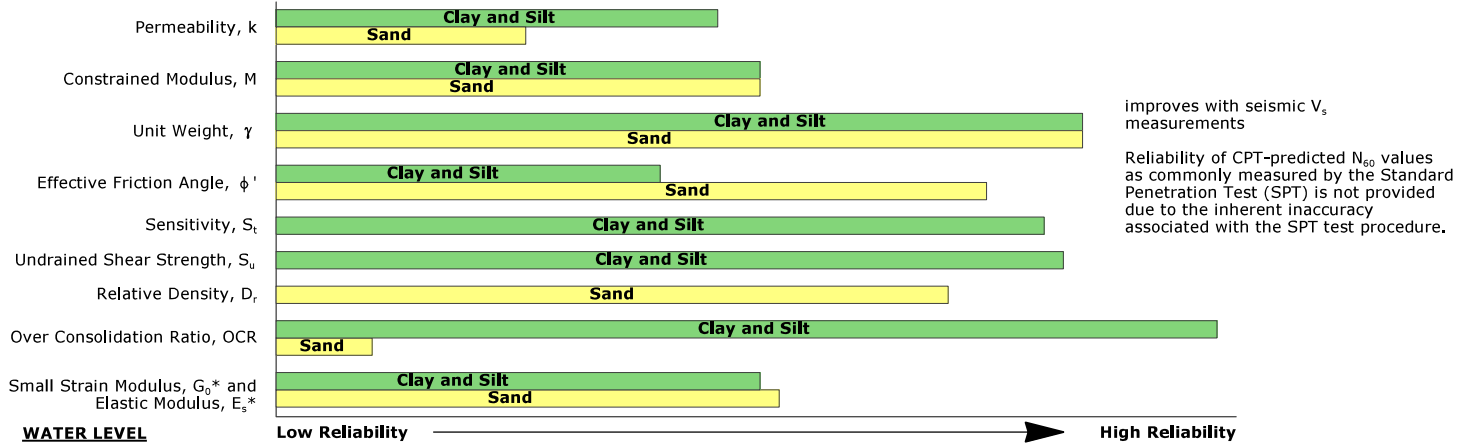
## DESCRIPTION OF GEOTECHNICAL CORRELATIONS

- Normalized Tip Resistance,  $Q_{tn}$   
 $Q_{tn} = ((q_t - \sigma_{v0})/P_a)(P_a/\sigma'_{v0})^n$   
 $n = 0.381(I_c) + 0.05(\sigma'_{v0}/P_a) - 0.15$
- Over Consolidation Ratio, OCR  
 $OCR(1) = 0.25(Q_{tn})^{1.25}$   
 $OCR(2) = 0.33(Q_{tn})$
- Undrained Shear Strength,  $S_u$   
 $S_u = Q_{tn} \times \sigma'_{v0}/N_{kt}$   
 $N_{kt}$  is a soil-specific factor (shown on  $S_u$  plot)
- Sensitivity,  $S_t$   
 $S_t = (q_t - \sigma_{v0}/N_{kt}) \times (1/f_s)$
- Effective Friction Angle,  $\phi'$   
 $\phi'(1) = \tan^{-1}(0.373[\log(q_t/\sigma'_{v0}) + 0.29])$   
 $\phi'(2) = 17.6 + 11[\log(Q_{tn})]$
- Unit Weight,  $\gamma$   
 $\gamma = (0.27[\log(F_r)] + 0.36[\log(q_t/atm)] + 1.236) \times \gamma_{water}$   
 $\sigma_{v0}$  is taken as the incremental sum of the unit weights
- Small Strain Shear Modulus,  $G_0$   
 $G_0(1) = \rho V_s^2$   
 $G_0(2) = 0.015 \times 10^{(0.55I_c + 1.68)}(q_t - \sigma_{v0})$
- Soil Behavior Type Index,  $I_c$   
 $I_c = [(3.47 - \log(Q_{tn}))^2 + (\log(F_r) + 1.22)^2]^{0.5}$
- SPT  $N_{60}$   
 $N_{60} = (q_t/atm) / 10^{(1.1268 - 0.2817I_c)}$
- Elastic Modulus,  $E_s$  (assumes  $q_t/q_{ultimate} \sim 0.3$ , i.e. FS = 3)  
 $E_s(1) = 2.6\psi G_0$  where  $\psi = 0.56 - 0.33\log Q_{tn, clean sand}$   
 $E_s(2) = G_0$   
 $E_s(3) = 0.015 \times 10^{(0.55I_c + 1.68)}(q_t - \sigma_{v0})$   
 $E_s(4) = 2.5q_t$
- Constrained Modulus,  $M$   
 $M = \alpha_M(q_t - \sigma_{v0})$   
For  $I_c > 2.2$  (fine-grained soils)  
 $\alpha_M = Q_{tn}$  with maximum of 14  
For  $I_c < 2.2$  (coarse-grained soils)  
 $\alpha_M = 0.0188 \times 10^{(0.55I_c + 1.68)}$
- Hydraulic Conductivity,  $k$   
For  $1.0 < I_c < 3.27$   $k = 10^{(0.952 - 3.04I_c)}$   
For  $3.27 < I_c < 4.0$   $k = 10^{(-4.52 - 1.37I_c)}$
- Relative Density,  $D_r$   
 $D_r = (Q_{tn} / 350)^{0.5} \times 100$

## REPORTED PARAMETERS

CPT logs as provided, at a minimum, report the data as required by ASTM D5778 and ASTM D7400 (if applicable). This minimum data include  $q_t$ ,  $f_s$ , and  $u$ . Other correlated parameters may also be provided. These other correlated parameters are interpretations of the measured data based upon published and reliable references, but they do not necessarily represent the actual values that would be derived from direct testing to determine the various parameters. To this end, more than one correlation to a given parameter may be provided. The following chart illustrates estimates of reliability associated with correlated parameters based upon the literature referenced below.

## RELATIVE RELIABILITY OF CPT CORRELATIONS



## WATER LEVEL

### Low Reliability

### High Reliability

The groundwater level at the CPT location is used to normalize the measurements for vertical overburden pressures and as a result influences the normalized soil behavior type classification and correlated soil parameters. The water level may either be "measured" or "estimated:"

*Measured* - Depth to water directly measured in the field

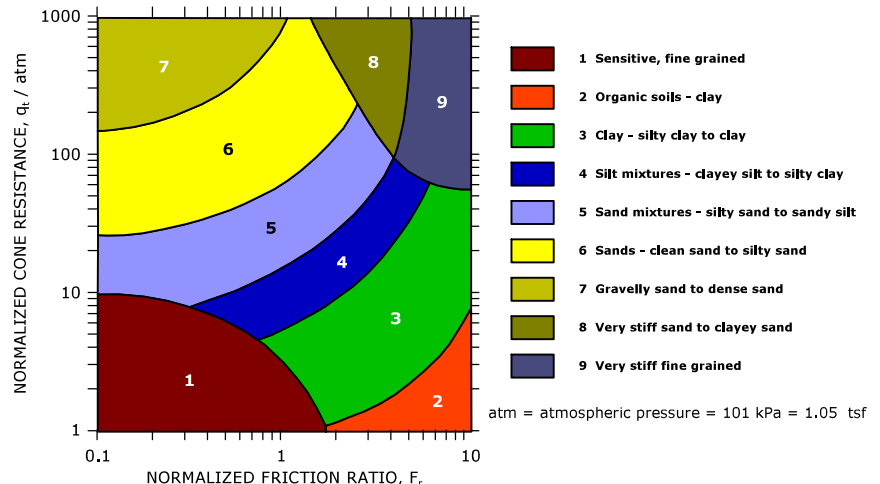
*Estimated* - Depth to water interpolated by the practitioner using pore pressure measurements in coarse grained soils and known site conditions

While groundwater levels displayed as "measured" more accurately represent site conditions at the time of testing than those "estimated," in either case the groundwater should be further defined prior to construction as groundwater level variations will occur over time.

## CONE PENETRATION SOIL BEHAVIOR TYPE

The estimated stratigraphic profiles included in the CPT logs are based on relationships between corrected tip resistance ( $q_t$ ), friction resistance ( $f_s$ ), and porewater pressure ( $u_2$ ). The normalized friction ratio ( $F_r$ ) is used to classify the soil behavior type.

Typically, silts and clays have high  $F_r$  values and generate large excess penetration porewater pressures; sands have lower  $F_r$ 's and do not generate excess penetration porewater pressures. The adjacent graph (Robertson *et al.*) presents the soil behavior type correlation used for the logs. This normalized SBT chart, generally considered the most reliable, does not use pore pressure to determine SBT due to its lack of repeatability in onshore CPTs.



## REFERENCES

- Kulhawy, F.H., Mayne, P.W., (1997). "Manual on Estimating Soil Properties for Foundation Design," Electric Power Research Institute, Palo Alto, CA.
- Mayne, P.W., (2013). "Geotechnical Site Exploration in the Year 2013," Georgia Institute of Technology, Atlanta, GA.
- Robertson, P.K., Cabal, K.L. (2012). "Guide to Cone Penetration Testing for Geotechnical Engineering," Signal Hill, CA.
- Schmertmann, J.H., (1970). "Static Cone to Compute Static Settlement over Sand," *Journal of the Soil Mechanics and Foundations Division*, 96(SM3), 1011-1043.

Unified Soil Classification System

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests <sup>A</sup>				Soil Classification	
				Group Symbol	Group Name <sup>B</sup>
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	Gravels: More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels: Less than 5% fines <sup>C</sup>	Cu≥4 and 1≤Cc≤3 <sup>E</sup>	GW	Well-graded gravel <sup>F</sup>
			Cu<4 and/or [Cc<1 or Cc>3.0] <sup>E</sup>	GP	Poorly graded gravel <sup>F</sup>
		Gravels with Fines: More than 12% fines <sup>C</sup>	Fines classify as ML or MH	GM	Silty gravel <sup>F, G, H</sup>
			Fines classify as CL or CH	GC	Clayey gravel <sup>F, G, H</sup>
	Sands: 50% or more of coarse fraction passes No. 4 sieve	Clean Sands: Less than 5% fines <sup>D</sup>	Cu≥6 and 1≤Cc≤3 <sup>E</sup>	SW	Well-graded sand <sup>I</sup>
			Cu<6 and/or [Cc<1 or Cc>3.0] <sup>E</sup>	SP	Poorly graded sand <sup>I</sup>
		Sands with Fines: More than 12% fines <sup>D</sup>	Fines classify as ML or MH	SM	Silty sand <sup>G, H, I</sup>
			Fines classify as CL or CH	SC	Clayey sand <sup>G, H, I</sup>
Fine-Grained Soils: 50% or more passes the No. 200 sieve	Silts and Clays: Liquid limit less than 50	Inorganic:	PI > 7 and plots above “A” line <sup>J</sup>	CL	Lean clay <sup>K, L, M</sup>
			PI < 4 or plots below “A” line <sup>J</sup>	ML	Silt <sup>K, L, M</sup>
		Organic:	$\frac{LL \text{ oven dried}}{LL \text{ not dried}} < 0.75$	OL	Organic clay <sup>K, L, M, N</sup> Organic silt <sup>K, L, M, O</sup>
	Silts and Clays: Liquid limit 50 or more	Inorganic:	PI plots on or above “A” line	CH	Fat clay <sup>K, L, M</sup>
			PI plots below “A” line	MH	Elastic silt <sup>K, L, M</sup>
		Organic:	$\frac{LL \text{ oven dried}}{LL \text{ not dried}} < 0.75$	OH	Organic clay <sup>K, L, M, P</sup> Organic silt <sup>K, L, M, Q</sup>
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

- <sup>A</sup> Based on the material passing the 3-inch (75-mm) sieve.

<sup>B</sup> If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

<sup>C</sup> Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

<sup>D</sup> Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

<sup>E</sup>  $Cu = D_{60}/D_{10}$      $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

<sup>F</sup> If soil contains  $\geq 15\%$  sand, add "with sand" to group name.

<sup>G</sup> If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
- <sup>H</sup> If fines are organic, add "with organic fines" to group name.

<sup>I</sup> If soil contains  $\geq 15\%$  gravel, add "with gravel" to group name.

<sup>J</sup> If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

<sup>K</sup> If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

<sup>L</sup> If soil contains  $\geq 30\%$  plus No. 200 predominantly sand, add "sandy" to group name.

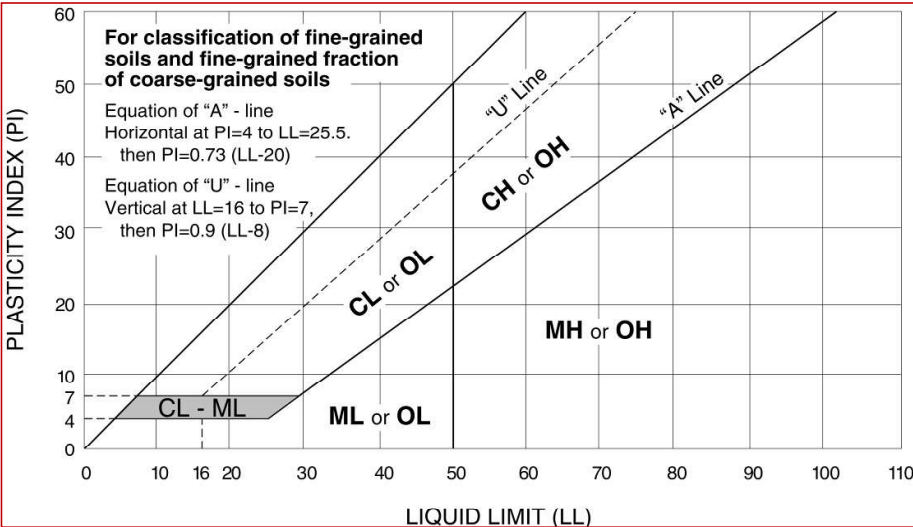
<sup>M</sup> If soil contains  $\geq 30\%$  plus No. 200, predominantly gravel, add "gravelly" to group name.

<sup>N</sup> PI  $\geq 4$  and plots on or above "A" line.

<sup>O</sup> PI < 4 or plots below "A" line.

<sup>P</sup> PI plots on or above "A" line.

<sup>Q</sup> PI plots below "A" line.





December 2, 2024

Terracon Consultants, Inc.  
2108 Capital Drive, Suite 103  
Wilmington, NC 28405

Attention: Mr. Justin DeNicola, P.E.

**Subject: Stormwater Soil Evaluations**  
**Project No. 24-051-SS**  
Pender County Hampstead Library  
US Highway 17  
Hampstead, NC

Dear Mr. DeNicola:

Terrain Environmental Consulting, PLLC (TEC) appreciates the opportunity to provide you with this report for stormwater soil evaluation services associated with the design and/or modification of stormwater control measures (SCMs) at the above referenced project site. The results of the testing are presented below.

## **PROJECT BACKGROUND**

TEC was contracted by Terracon to perform soil evaluation services, specifically seasonal high water table (SHWT) evaluations and hydraulic conductivity (Ksat) testing, to assist with the design of a potential modification to an existing SCM at the above referenced project site into an infiltration basin. An aerial photograph showing two test locations (SCM-01 and SCM-02) was provided and they were staked in the field prior to our mobilization.

Review of the Web Soil Survey showed the areas at test locations are mapped with the Alpin soil series. This series is generally described as excessively drained soils formed in eolian and marine deposits on uplands and river terraces with an expected SHWT greater than 80 inches below the ground surface. It should be noted that the test locations are inside of an existing SCM that has been excavated several feet into the ground.

## **RESULTS**

### **Seasonal High Water Table Evaluations**

The SHWT evaluations were performed on November 19, 2024 by advancing hand auger borings at both of the locations, as shown on the attached Stormwater Soil Evaluations sketch (**Figure 1**). The hand auger borings were advanced to depths ranging from approximately 44 to 45 inches below the existing ground surface. Soils

were evaluated by a Licensed Soil Scientist for evidence of SHWT influence. This evaluation involved looking at the actual moisture content in the soil and observing the matrix and mottle colors. Depending on the soil texture, the soil color will indicate processes that are driven by SHWT fluctuations such as iron reduction and oxidation and organic matter staining.

Soils at both test locations consisted of loamy sand surface horizons underlain by loamy sand to fine sand horizons. The SHWT was observed to range from 17 to 25 inches below the surface. The Observed Water Table (OWT) was encountered at a depths of approximately 42 to 44 inches.

A Soil Profile Description sheet, which provides a description of the observed soil horizons and the estimated SHWT depths, has also been included with this report.

### Ksat Testing

TEC personnel performed in-situ saturated hydraulic conductivity (Ksat) testing at both of the test locations after the SHWT evaluations were complete. Specifically, the constant-head well permeameter technique (also known as shallow well pump-in technique and bore hole permeameter method) was used. This procedure is described in Methods of Soil Analysis, Part 1., Chapter 29 – Hydraulic Conductivity of Saturated Soils: Field Methods, 29 – 3.2 Shallow Well Pump In Method, pp. 758-763 and in the Soil Science Society of America Journal, Vol. 53, no. 5, Sept. – Oct. 1989, “A Constant-head Permeameter for Measuring Saturated Hydraulic Conductivity of the Vadose Zone” and “Comparison of the Glover Solution with the Simultaneous – Equations Approach for Measuring Hydraulic Conductivity.” This method involves allowing a measured volume of water to percolate through the soil until a steady rate of flow is achieved. The steady state rate is used to calculate the Ksat of the soil horizon using the Glover equation.

As requested by the design engineer, the Ksat tests at both locations were performed approximately 6 inches below the surface of the SCM bottom. The Ksat rates were calculated as ranging from 4.89 to 7.65 inches per hour.

See Table 1 below for a summary of the soil evaluation results.

TABLE 1				
TEST LOCATION	SHWT (inches below ground surface)	OWT (inches below ground surface)	Ksat Testing Interval (inches below ground surface)	Ksat RATE (inches per hour)
SCM-01	17 inches	42 inches	1 to 7 inches	7.65 in/hr
SCM-02	25 inches	44 inches	1 to 7 inches	4.89 in/hr

## DISCUSSION

Potential evidence for water or water table influence was observed above our reported SHWT at both test locations. This included the presence of low-chroma organic accumulations at SCM-01 and low-chroma soil matrix colors at SCM-02. At SCM-01, the organic accumulations could be due to the influx of stormwater and/or organic material washing in. The low-chroma matrix soil at SCM-02 appeared similar to a spodic horizon but was not cemented and not heavily laden with organics, and better-drained soils were observed beneath. This suggests either a perched condition or that the low-chroma soils are not indicative of water table influence. In order to further evaluate our findings, we reviewed the stormwater permit file for the existing SCM at NC Department of Environmental Quality. The file included a soil report prepared by ECS Carolinas, LLP dated November 1, 2013 which indicated that the SHWT was observed at 70 to 72 inches below the pre-construction ground surface. Detailed soil profile descriptions using typical soil science practices (i.e. soil matrix colors via Munsell color chart, redox features observed, structure, consistence) were not provided but rather a general soil description with a reported SHWT depth, thus limiting our ability to compare the soil profile pre-construction to current conditions. However, the soil report indicated the presence of a hardpan encountered at 70 inches in one of the two test locations which was used as the basis for the SHWT determination at that location, and possibly at the other test location as well. Additionally, the file indicated that the SCM permitted and constructed at that time was an infiltration basin which required a minimum two feet of separation between the basin bottom and the SHWT. Review of the permit design drawings appeared to indicate that the basin bottom was excavated approximately two feet above SHWT. As such, additional excavation into the existing SCM would likely result in the bottom of the new SCM being too close to the SHWT to be compliant with current stormwater design regulations unless a detailed hydrogeologic evaluation is performed to show that any groundwater mound resulting from the design storm event will dissipate within three days. In which case, the separation above SHWT can be reduced to one foot.

## CLOSING

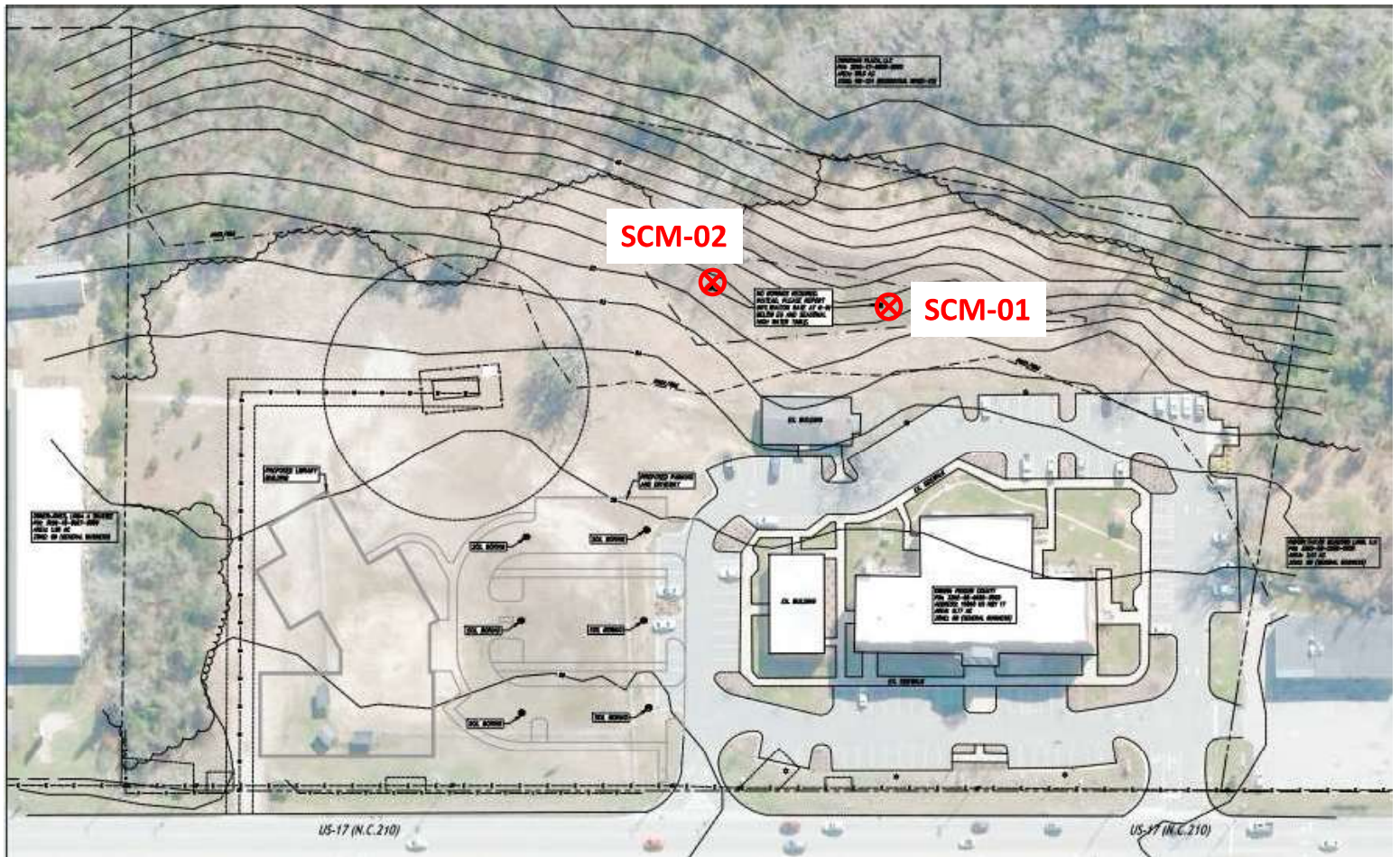
We appreciate the opportunity to provide stormwater soil evaluation services. If you have any questions, please do not hesitate to contact me.

Sincerely,



Paul Masten, LSS, PWS  
President/Owner

Attachments  
Figure 1 – Stormwater Soil Evaluations  
Soil Profile Descriptions



Site plan provided by Terracon



Stormwater Soil Evaluations  
Pender County Hampstead Library  
Hampstead, NC  
Project Number 24-051-SS

**Figure 1**

**SOIL PROFILE DESCRIPTIONS**  
**Pender County Hampstead Library**  
**US Highway 17**  
**Hampstead, NC**

<b>Location</b>	<b>Horizon</b>	<b>Depth (inches)</b>	<b>Matrix</b>	<b>Mottles</b>	<b>Texture, Structure, Consistence</b>
SCM-01	1	0-11	7.5YR 2.5/3	7.5YR 2.5/2	Very dark brown loamy sand, granular, very friable; very dark brown organic accumulations
	2	11-17	10YR 5/3	10YR 4/3 10YR 2/2	Brown fine sand, single grain, loose; common brown redox depletions and very dark brown organic accumulations
	3	17-40	7.5YR 2.5/2	10YR 2/1	Very dark brown loamy sand, weak, medium sub-angular blocky, friable; black organic accumulations
	4	40-44	7.5YR 2.5/1		Black loamy sand, moderate, medium sub-angular blocky, friable
Seasonal High Water Table = 17 inches below the existing ground surface. Water table observed at 42 inches below the ground surface.					
SCM-02	1	0-6	10YR 3/3		Dark brown loamy sand, granular, very friable
	2	6-16	10YR 2/2		Very dark brown loamy sand, weak, medium angular blocky, friable
	3	16-20	10YR 4/4		Dark yellowish brown fine sand, single grain, loose
	4	20-25	10YR 5/4		Yellowish brown fine sand, single grain, loose
	5	25-45	10YR 5/3	10YR 7/2 10YR 5/8 10YR 3/1	Brown fine sand, single grain, loose; common light gray redox depletions, yellowish brown redox concentrations and very dark gray organic accumulations
Seasonal High Water Table = 25 inches below the existing ground surface. Water table observed at 44 inches below the ground surface.					



2108 Capital Drive  
Wilmington, NC 28405  
P (910) 478-9915  
North Carolina Registered, F-0869  
**Terracon.com**

June 25, 2025

Pender County  
805 S Walker Street  
Burgaw, North Carolina 28425

Attn: Mr. Allen Vann – Assistant County Manager  
E: [avann@pendercountync.gov](mailto:avann@pendercountync.gov)

Re: Addendum 1 – Fire Lane Pavements  
Hampstead Library  
15060 US-17  
Hampstead, North Carolina  
Terracon Project No. K6245099

Dear Mr. Vann:

This addendum to our geotechnical engineering report (Terracon Report No. K6245099 dated December 13, 2024) provides additional information related to the fire lane pavements for the proposed project.

The medium duty asphalt pavement section in the above referenced report will support a 75,000-pound fire truck apparatus as required by the North Carolina Building Code.

We understand grass pavers will also be installed for a portion of the fire lane on site. We have reviewed the manufacturer's letter (*Grasspave2 Compressive Strength Capability* dated June 23, 2025) certifying the product will support a 75,000-pound fire truck apparatus with a recommended 10-12-inch base course depth. We recommend the grass paver detail prepared by the site civil engineer meet the minimum base course depth as specified by the manufacturer. Additionally, we understand the grass paver system is not being used for stormwater management (infiltration mechanism) and recommend the base course material consist of aggregate base course material as specified in the above referenced report.

We recommend third party construction materials testing and inspections be performed during construction to document the construction of the pavement sections.

Please refer to the above referenced geotechnical report for recommendations regarding other geotechnical related aspects of the project.

**Addendum 1 – Fire Lane Pavements**

Hampstead Library | Hampstead, North Carolina  
June 25, 2025 | Terracon Project No. K6245099



We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this addendum or if we may be of further service, please contact us.

Sincerely,

**Terracon**



Justin L. DeNicola, P.E.  
Operations Manager  
Registered, NC 046129

A handwritten signature in blue ink that reads 'Thomas M. Schipporeit'.

Tom Schipporeit, P.E., BC.GE  
Senior Geotechnical Engineer

## FIRE HYDRANT FLOW TEST RESULTS

### TEST LOCATION

Address: 15060 Hwy 17, Hampstead

Proposed Tap Location: \_\_\_\_\_

Requested Flow Location: nearest hydrant to the proposed point of connection

### APPLICANT

Name: Sawyer Sherwood & Associate Architecture

Address: 124 Market Street, Wilmington, NC 28401

Contact Person: Scott Spike Phone: 910.762.0892 Fax: \_\_\_\_\_

### TESTING AGENT

Firm Name: Andrew King Engineering, PLLC

Address: 5917 Shedd Drive, Raleigh, North Carolina 27603

Phone: (919) 906-5236 Email: Drew@AndrewKingEngineering.com

### SYSTEM ANALYSIS

Main Size: 16"

Elevation of Test Location: 58' +/-

Nearest Elevated Tank: Hampstead

Time of Test: 10:15 AM

Tank Elevation: 173' (131')

Pressure Zone: 188.2' (146.2')

Theoretical Pressure: 49.8 psi

Calculated by: Drew King

Witnessed by: Chris Radke & Cody Blanton

### RESULTS

Static Pressure: 55 psi

3.05" Pitotless Nozzle Reading: 20 psi

Residual Pressure: 51 psi

Volume: 1,682 gpm

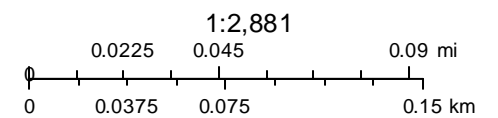
Disclaimer: These results are an instantaneous snap-shot of the system. It is recommended that the designer allow adequate safety to include low tank level.

Comments: Flowed ( 1 ) BigBoy Hose Monster. C = 1.35

Completed by: Drew King

Date: 6/4/2025

# 15060 Hwy 17, Hampstead



# Hydrant Flow Test Report

Test Date 6/4/2025

Test Time 10:15 AM

## Location

Hampstead Library  
15060 Hwy 17  
Hampstead, NC

## Tested by

Andrew King Engineering, PLLC  
5917 Shedd Drive  
Raleigh, NC 27603  
Drew@AndrewKingEngineering.com  
919-906-5236

## Notes

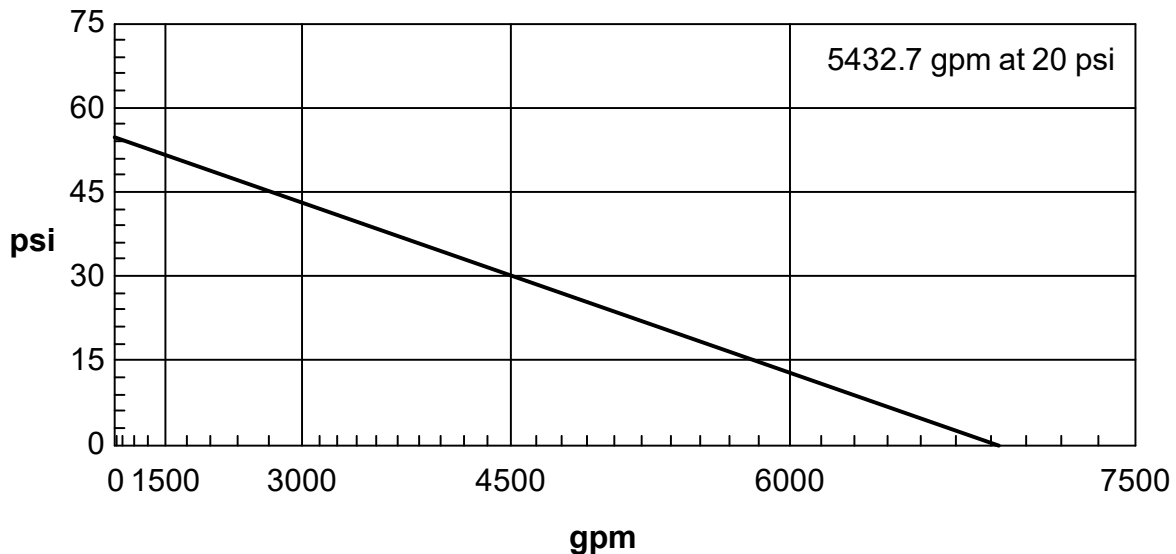
## Read Hydrant

55 psi static pressure  
51 psi residual pressure  
58 ft hydrant elevation

## Flow Hydrant(s)

Outlet	Elev	Size	C	Pitot Pressure	Flow
#1	54	3.05	1.35	20	1682 gpm

## Flow Graph





#### THIS DEVICE IS FM APPROVED

The pressure vs. flow rate data developed within this flow chart is based on the average K-factor measured during laboratory testing. This data has been determined to be within the acceptable limitations for accuracy. It is the user's responsibility to verify that the correct chart and column is being used.

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PSI	GPM	PSI	GPM
5	856	31	2093
6	938	32	2127
7	1013	33	2160
8	1083	34	2192
9	1149	35	2224
10	1211	36	2256
11	1270	37	2287
12	1303	38	2318
13	1356	39	2323
14	1407	40	2353
15	1456	41	2382
16	1504	42	2411
17	1550	43	2439
18	1595	44	2468
19	1639	45	2495
20	1682	46	2523
21	1723	47	2550
22	1764	48	2577
23	1803	49	2604
24	1842	50	2630
25	1880	51	2657
26	1917	52	2683
27	1954	53	2708
28	1990	54	2734
29	2025	55	2759
30	2059		

## COEFFICIENT AND K-FACTOR TABLE FOR VARIOUS FLOW DEVICES

PITOTLESS NOZZLE™	K-FACTOR	COEFFICIENT	ORIFICE DIAMETER	psi RANGE	FLOW RANGE (GPM)
2" Pitotless Nozzle + Little Hose Monster	156.0	1.31	2"	10-70	493-1305
2" Pitotless Nozzle + 2 1/2" Hose Monster	164.8	1.38	2"	10-70	521-1379
2" Pitotless Nozzle + Open Atmosphere	167.2	1.40	2"	10-70	529-1399
1 3/4" Pitotless Nozzle + Little Hose Monster	104.7	1.15	1.75"	10-80	331-936
1 3/4" Pitotless Nozzle + 2 1/2" Hose Monster	106.6	1.17	1.75"	10-80	337-953
1 3/4" Pitotless Nozzle + Open Atmosphere	109.7	1.20	1.75"	10-80	347-981
1 1/8" Pitotless Nozzle + Little Hose Monster	37.2	0.98	1.125"	10-80	83-333
1 1/8" Pitotless Nozzle + 2 1/2" Hose Monster	37.4	0.99	1.125"	10-80	84-335
1 1/8" Pitotless Nozzle + Open Atmosphere	37.0	0.98	1.125"	10-80	83-331
1" Pitotless Nozzle + Little Hose Monster	27.2	0.91	1"	3-80	47-243
1" Pitotless Nozzle + 2 1/2" Hose Monster	27.6	0.93	1"	3-80	48-247
1" Pitotless Nozzle + Open Atmosphere	27.7	0.93	1"	3-80	48-248

IN-LINE PITOTLESS NOZZLE™	K-FACTOR	COEFFICIENT	ORIFICE DIAMETER	psi RANGE	FLOW RANGE (GPM)
2" In-line Pitotless Nozzle	165.3	1.38	2"	10-75	523-1432
1 3/4" In-line Pitotless Nozzle	109.9	1.20	1.75"	5-80	246-983
1 1/8" In-line Pitotless Nozzle	38.4	1.02	1.125"	5-70	86-321
1 1/2" In-line Pitotless Nozzle	31.7	1.06	1.0"	2-90	45-301

BIGBOY HOSE MONSTER™	K-FACTOR	COEFFICIENT	ORIFICE DIAMETER	psi RANGE	FLOW RANGE (GPM)
5-11psi (BigBoy Hose Monster)	382.9	1.38	3.05"	5-11	856-1270
12-38psi (BigBoy Hose Monster)	376.0	1.35	3.05"	12-38	1303-2318
39-55psi (BigBoy Hose Monster)	372.0	1.34	3.05"	39-55	2323-2759

NOTE: Due to the shape and size of the BigBoy Pitotless Nozzle, the BigBoy Hose Monster uses three different K-factors over its operating range.

2 1/2" Hose Monster®	K-FACTOR	COEFFICIENT	ORIFICE DIAMETER	psi RANGE	FLOW RANGE (GPM)
2 1/2" Hose Monster	168.67	0.906	2.5"	10-70	533-1411
1 3/4" Nozzle Insert	89.04	0.975	1.75"	10-70	282-745
1 1/8" Nozzle Insert	37.36	0.990	1.25"	10-70	118-313
4" & 4 1/2" Hose Monster®	K-FACTOR	COEFFICIENT	CONNECTION DIAMETER	psi RANGE	FLOW RANGE (GPM)
4 1/2" Hose Monster	331.07	0.548	4.5"	10-70	1047-2770
4" Hose Monster	339.65	0.712	4"	10-70	1074-2842

## USING SOFTWARE

Use the table to the right if you are using software that requires the coefficient input to be less than '1.0.' Notice that the orifice diameter must be changed from its true diameter in order to accommodate the lower coefficient. This is necessary only for the 2" Pitotless Nozzle and the 3/4" Pitotless Nozzle.

DEVICE	COEFFICIENT	ORIFICE DIAMETER
--------	-------------	------------------

2" Pitotless Nozzle + Little Hose Monster	0.99	2.30"
2" Pitotless Nozzle + 2 1/2" Hose Monster	0.99	2.36"
2" Pitotless Nozzle + Open Atmosphere	0.99	2.38"
1 3/4" Pitotless Nozzle + Little Hose Monster	0.99	1.88"
1 3/4" Pitotless Nozzle + 2 1/2" Hose Monster	0.99	1.90"
1 3/4" Pitotless Nozzle + Open Atmosphere	0.99	1.93"

NOTE: If your software uses the Theoretical Discharge Formula, found in NFPA 291, 4.7.3, the coefficient of discharge can be used to produce flow rates that will match our flow charts.

## A HAND-HELD PITOT DIRECTLY AT A HYDRANT OUTLET

OUTLET TYPE	COEFFICIENT
Outlet smooth and rounded	0.9
Outlet square and sharp	0.8
Outlet square and projecting into barrel	0.7
If a stream straightener is used	0.95

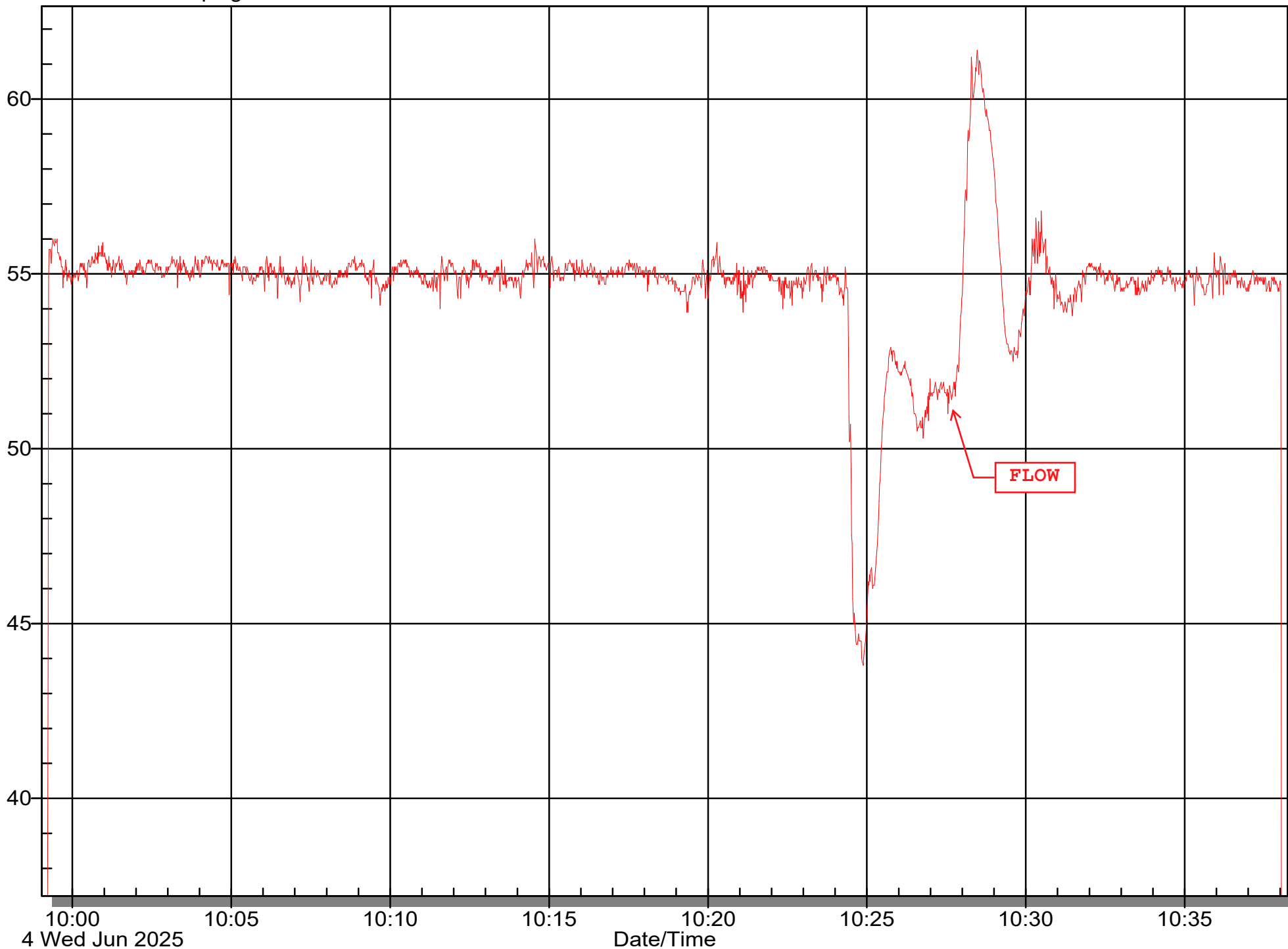
## CLASSIFYING AND MARKING OF HYDRANTS

Rated Capacity at 20psi	Class	Marking Color of Hydrant Tops and Nozzles
≥1500 GPM	AA	Light Blue
1000-1499 GPM	A	Green
500-999 GPM	B	Orange
≤499 GPM	C	Red

The above are the NFPA hydrant classifications and color marking for various rated capacities. Source NFPA 291, Chapter 5 2019

# 15060 Hwy 17, Hampstead flow test - Wednesday, June 4, 2025

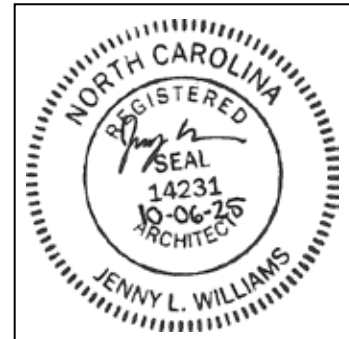
AKE1-Pressure/psig Min: -0.4 Max: 61.4



## ARCHITECTURAL

### Sawyer Sherwood & Associate Architecture

124 Market Street  
Wilmington, NC 28401  
Tel: 910-762-0892



Jenny Williams, AIA  
(Email: jenny@s2a3.com)

#### DIVISION 01

##### GENERAL REQUIREMENTS

- 01 1000 Summary
- 01 1200 Allowances
- 01 2200 Unit Prices
- 01 2500 Substitution Requirements
- 01 3000 Administrative Requirements
- 01 3216 Construction Progress Schedule
- 01 4000 Quality Requirements
- 01 5000 Temporary Facilities and Controls
- 01 5813 Temporary Project Signage
- 01 6000 Product Requirements
- 01 7000 Execution and Closeout Requirements
- 01 7419 Construction Waste Management and Disposal
- 01 7800 Closeout Submittals
- 01 7900 Demonstration and Training

#### DIVISION 02

##### EXISTING CONDITIONS

- 02 4100 Demolition

#### DIVISION 03

##### CONCRETE

- 03 3511 Concrete Floor Finishes

#### DIVISION 04

##### MASONRY

- 04 2000 Unit Masonry
- 04 7200 Cast Stone Masonry

#### DIVISION 05

##### METALS

- 05 5133 Metal Ladders

#### DIVISION 06

##### WOOD, PLASTIC, AND COMPOSITES

- 06 4100 Architectural Wood Casework

#### DIVISION 07

##### THERMAL AND MOISTURE PROTECTION

- 07 0553 Fire and Smoke Assembly Identification
- 07 1300 Sheet Waterproofing
- 07 2100 Thermal Insulation
- 07 2700 Air Barriers
- 07 4213 Metal Wall Panels
- 07 5400 Thermoplastic Membrane Roofing
- 07 7100 Roof Specialties
- 07 7123 Manufactured Gutters and Downspouts
- 07 7200 Roof Accessories

07 8400 Firestopping  
07 9100 Preformed Joint Seals  
07 9200 Joint Sealants

**DIVISION 08**

**OPENINGS**

08 1116 Aluminum Doors and Frames  
08 1416 Flush Wood Doors  
08 3100 Access Doors and Panels  
08 4229 Automatic Entrances  
08 4313 Aluminum-Framed Storefronts  
08 4413 Glazed Aluminum Curtain Walls  
08 7100 Door Hardware  
08 8000 Glazing  
08 9200 Louvered Equipment Enclosures

**DIVISION 09**

**FINISHES**

09 0561 Common Work Results for Flooring Preparation  
09 2116 Gypsum Board Assemblies  
09 3000 Tiling  
09 5100 Acoustical Ceilings  
09 6500 Resilient Flooring  
09 6813 Tile Carpeting  
09 8430 Sound Absorbing Wall and Ceiling Units  
09 9113 Exterior Painting  
09 9123 Interior Painting  
09 9300 Staining and Transparent Finishing

**DIVISION 10**

**SPECIALTIES**

10 1100 Visual Display Units  
10 1416 Plaques  
10 1419 Dimensional Letter Signage  
10 1423 Panel Signage  
10 1426 Post and Panel Signage  
10 1433 Illuminated Cabinet Signage  
10 2113.17 Phenolic Toilet Compartments  
10 2600 Wall and Door Protection  
10 2800 Toilet, Bath, and Laundry Accessories  
10 4400 Fire Protection Specialties

**DIVISION 11**

**EQUIPMENT**

11 1700 Teller and Service Equipment  
11 5213 Projection Screens  
11 5271 Projector Mounts

**DIVISION 12**

**FURNISHINGS**

12 1230 Art Hanging and Display Systems  
12 2400 Window Shades  
12 3600 Countertops

**DIVISION 13**

**SPECIAL CONSTRUCTION**

13 3400 Fabricated Engineered Structures

**DIVISION 31**

**EARTHWORK**

31 3116 Termite Control

**END OF ARCHITECTURAL SPECIFICATIONS**

## STRUCTURAL

**Woods Engineering, PA**  
254 N. Front Street, Suite 201  
Wilmington, NC 28401  
Tel: 910-343-8007



Adam Sisk, PE, SE  
(Email: [adam@woodseng.com](mailto:adam@woodseng.com))

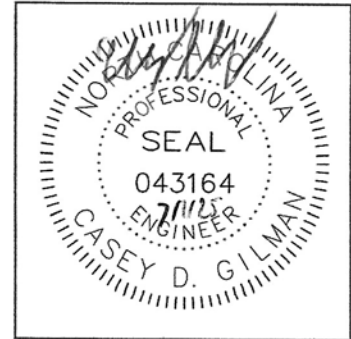
<b>DIVISION 01</b>	<b>GENERAL REQUIREMENTS</b> 01 4533 Special Inspections
<b>DIVISION 03</b>	<b>CONCRETE</b> 03 3000 Cast-in-Place Concrete
<b>DIVISION 05</b>	<b>STEEL</b> 05 1200 Structural Steel Framing
<b>DIVISION 06</b>	<b>WOOD, PLASTIC, AND COMPOSITES</b> 06 1000 Rough Carpentry 06 1600 Sheathing 06 1753 Shop Fabricated Wood Trusses

**END OF STRUCTURAL SPECIFICATIONS**

**FIRE PROTECTION & PLUMBING**

**Cheatham and Associates, P.A.**

3412 Enterprise Drive  
Wilmington, NC 28405  
Tel: 910-452-4210



**Casey D. Gilman, PE, LEED AP**  
(Email: [cgilman@cheathampa.com](mailto:cgilman@cheathampa.com))

**DIVISION 21**            **FIRE SUPPRESSION**  
21 0000   Fire Protection

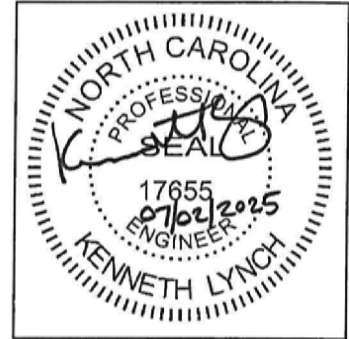
**DIVISION 22**            **PLUMBING**  
22 0000   Plumbing

**END OF FIRE PROTECTION & PLUMBING SPECIFICATIONS**

**MECHANICAL**

**Cheatham and Associates, P.A.**

3412 Enterprise Drive  
Wilmington, NC 28405  
Tel: 910-452-4210



**Kenneth Lynch, PE, LEED AP**  
(Email: [klynch@cheathampa.com](mailto:klynch@cheathampa.com))

**DIVISION 23**

**HEATING, VENTILATING, AND AIR-CONDITIONING**

23 0500 Heating and Air Conditioning

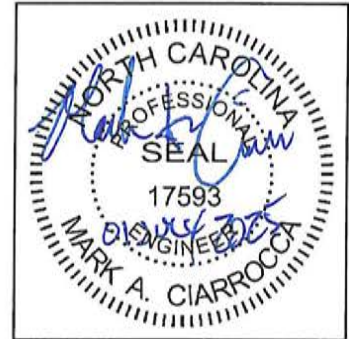
23 0900 Instrumentation and Control for HVAC

**END OF MECHANICAL SPECIFICATIONS**

## ELECTRICAL, COMMUNICATIONS, & FIRE ALARM

### Cheatham and Associates, P.A.

3412 Enterprise Drive  
Wilmington, NC 28405  
Tel: 910-452-4210



Mark A. Ciarrocca, PE  
(Email: [mciarrocca@cheatham.com](mailto:mciarrocca@cheatham.com))

#### DIVISION 26

##### ELECTRICAL

26 0000 Electrical, Basics  
26 0500 Basic Materials and Methods  
26 0519 Conductors and Cables  
26 0526 Grounding and Bonding  
26 0533 Raceways and Boxes  
26 0553 Electrical Identification  
26 0923 Lighting Control Devices  
26 2416 Panelboards  
26 2726 Wiring Devices  
26 2816 Enclosed Switches and Circuit Breakers  
26 3213 Engine Generators  
26 3600 Transfer Switches  
26 4313 Surge Protective Devices  
26 5119 LED Interior Lighting

#### DIVISION 27

##### COMMUNICATIONS

27 1500 Communications Horizontal Cabling

#### DIVISION 28

##### ELECTRONIC SAFETY AND SECURITY

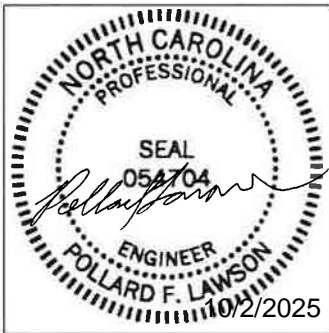
28 3111 Digital, Addressable, Fire Alarm System  
28 5000 Emergency Responder Communication Coverage System

**END OF ELECTRICAL, COMMUNICATIONS, & FIRE ALARM SPECIFICATIONS**

**CIVIL**

**CLH Design, PA**

400 Regency Forest Drive, Suite 120  
Cary, NC 27518  
Tel: 919-319-6716



**Pollard F. Lawson**  
(Email: [plawson@clhdesignpa.com](mailto:plawson@clhdesignpa.com))



**Troy R. Olson**  
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**DIVISION 31**

**EARTHWORK**

- 31 1000 Site Clearing
- 31 2000 Earth Moving
- 31 2500 Erosion & Sediment Controls

**DIVISION 32**

**EXTERIOR IMPROVEMENTS**

- 32 1216 Asphalt Paving
- 32 1313 Concrete Paving
- 32 1415 Unit Paving
- 32 4000 Site Furnishings
- 32 8400 Irrigation Systems Performance
- 32 9000 Planting

**DIVISION 33**

**UTILITIES**

- 33 4000 Storm Drainage

**END OF CIVIL SPECIFICATIONS**

**SITE SEWER UTILITIES**

**RSC Engineering, PLLC**  
15226 US Hwy. 17  
Hampstead, NC 28443  
Tel: 910-270-9599



**Anthony C. Braam**

**DIVISION 33**

**UTILITIES**

33 1000 Site Water Utilities  
33 3000 Site Sewer Utilities

**END OF SITE SEWER UTILITIES SPECIFICATIONS**

## **SECTION 01 1000 SUMMARY**

### **PART 1 GENERAL**

#### **1.01 PROJECT**

- A. Project Name: Pender County Library, Hampstead Branch
- B. Owner's Name: Pender County.
- C. Architect's Name: Sawyer Sherwood & Associate, P.C..
- D. The Project consists of the construction of a new 20,000 square foot library and associated site improvements. Project site is adjacent to existing County buildings, and existing utility water well, that will remain in operation throughout construction. Site improvements include relocation of underground power and water lines serving an existing utility water well, domestic and fire sprinkler water service lines to library from water main at US Hwy 17, sanitary sewer with lift station and connection to existing force main on the other side of US Hwy 17, stormwater improvements connecting to existing stormwater basin, grading for the building and parking areas, curb and gutter and paving for parking lot, and landscaping. Building includes slab on grade with monolithic strip footings, loadbearing wood stud wall framing with sawn and LSL studs, wood panel sheathing, and batt insulation. Roof framed with wood roof trusses and glue laminated girders and rafters, with plywood and tongue-and-groove wood roof deck as indicated on drawings. Exterior wall finishes include metal wall panels and brick masonry veneer. Roofing includes low-slope membrane over cover board and continuous insulation. Interior walls framed with wood studs. Floor finishes include tile carpeting, porcelain tile, and resilient tile. Wall finishes include painted gypsum wall board, porcelain tile, and wall protection panels. Ceiling finishes include acoustic ceiling tiles, and stained wood roof deck. Additional acoustic treatments include wall- and ceiling-mounted acoustic panels. Exterior openings include aluminum curtain wall and storefront with insulating glazing. Interior openings include storefront with monolithic or laminated glazing, and aluminum or flush wood doors.

#### **1.02 CONTRACT DESCRIPTION**

- A. Contract Type: A single prime contract based on a Stipulated Price as described in the agreement.

#### **1.03 WORK BY OWNER**

- A. Items noted NIC (Not in Contract) will be supplied and installed by Owner after Date of Substantial Completion. Some items include:
  - 1. Furnishings.
  - 2. Domestic appliances.
  - 3. Fire extinguishers.
  - 4. Information technology equipment and wireless access points.
  - 5. Projectors.
- B. Owner's vendor will supply and install the following:
  - 1. Security camera system: Camera system by Owner's vendor, connected to cabling in conduits and junction boxes that are included in the construction contract.
  - 2. Access control system power supply and controller, to be located in Data Room D1; system to connect to cabling in conduits and junction boxes that are included in the construction contract.
  - 3. Audio Visual system: AV system in Meeting Room 106 and Multipurpose Room 110 by Owner's vendor, and speakers at locations indicated on drawings, connected to cabling in conduits and junction boxes that are included in construction contract.
- C. Owner will supply the following for installation by Contractor:
  - 1. Dispensers for toilet paper, paper towels, and hand soap.
  - 2. Sanitary napkin disposal.

#### **1.04 OWNER OCCUPANCY**

- A. Owner intends to occupy the Project upon Substantial Completion, and continue to occupy adjacent portions of the site and premises throughout construction.
- B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- C. Schedule the Work to accommodate Owner occupancy.

#### **1.05 CONTRACTOR USE OF SITE**

- A. Construction Operations: Limited to areas noted on Drawings.
  - 1. Locate and conduct construction activities in ways that will limit disturbance to site.
- B. Arrange use of site to allow:
  - 1. Owner occupancy.
  - 2. Work by Others.
  - 3. Work by Owner.
  - 4. Use of site by the public.
- C. Provide access to and from site as required by law and by Owner:
  - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
  - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.
- D. Utility Outages and Shutdown:
  - 1. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
  - 2. Limit shutdown of utility services, and coordinate shutdowns in advance with Owner. Coordinate work to minimize shutdown length, and limit disruptions.
  - 3. Prevent accidental disruption of utility services to other facilities.

#### **PART 2 PRODUCTS - NOT USED**

#### **PART 3 EXECUTION - NOT USED**

**END OF SECTION 01 1000**

**SECTION 01 2100  
ALLOWANCES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Contingency allowances.

**1.02 RELATED REQUIREMENTS**

- A. Section 28 5000 - Emergency Radio Communication Enhancement System: Work related to contingency allowance.

**1.03 CONTINGENCY ALLOWANCE**

- A. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit will be included in Change Orders authorizing expenditure of funds from these Contingency Allowances.
- B. At closeout of Contract, funds remaining in Contingency Allowances will be credited to Owner by Change Order.

**1.04 ALLOWANCES SCHEDULE**

- A. Owner Contingency Allowance: Include the stipulated sum/price of \$475,000.00 for use upon Owner's instructions.
- B. Emergency Radio Communication Enhancement System Contingency Allowance: Include the stipulated sum/price of \$30,000.00, for use upon Owner's instructions, to provide an in-building radio signal amplification system, as indicated on drawings and specified in Section 28 5000 - Emergency Radio Communication Enhancement System, if signal strength mapping indicates a system is required. \*\*\*Base bid shall include initial signal strength mapping and pre-final signal strength mapping per Section 28 5000.\*\*\*

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION 01 2100**

## **SECTION 01 2200 UNIT PRICES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. List of unit prices, for use in preparing Bids.
- B. Measurement and payment criteria applicable to Work performed under a unit price payment method.
- C. Defect assessment and non-payment for rejected work.

#### **1.02 RELATED REQUIREMENTS**

- A. Instructions to Bidders: Instructions for preparation of pricing for Unit Prices.

#### **1.03 COSTS INCLUDED**

- A. Unit Prices included on the Bid Form shall include full compensation for all required labor, products, tools, equipment, plant, transportation, disposal fees, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

#### **1.04 UNIT QUANTITIES SPECIFIED**

- A. Quantities indicated in the Schedule of Unit Prices are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

#### **1.05 MEASUREMENT OF QUANTITIES**

- A. Measurement methods delineated in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the individual specification section govern.
- B. Take all measurements and compute quantities. Measurements and quantities will be verified by Architect or soils and materials engineer employed by the Owner, as indicated in the Unit Prices listed below.
- C. Assist by providing necessary equipment, workers, and survey personnel as required.
- D. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.
- E. Measurement by Area: Measured by square dimension using mean length and width or radius.
- F. Stipulated Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as a completed item or unit of the Work.
- G. Contractor's Engineer Responsibilities: Sign surveyor's field notes or keep duplicate field notes , calculate and certify quantities for payment purposes.

#### **1.06 PAYMENT**

- A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Architect, multiplied by the unit price.
- B. Payment will not be made for any of the following:
  - 1. Products wasted or disposed of in a manner that is not acceptable.
  - 2. Products determined as unacceptable before or after placement.
  - 3. Products not completely unloaded from the transporting vehicle.
  - 4. Products placed beyond the lines and levels of the required Work.
  - 5. Products remaining on hand after completion of the Work.
  - 6. Loading, hauling, and disposing of rejected Products.

#### **1.07 DEFECT ASSESSMENT**

- A. Replace Work, or portions of the Work, not complying with specified requirements.

- B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct one of the following remedies:
  - 1. The defective Work may remain, but the unit price will be adjusted to a new unit price at the discretion of Architect.
  - 2. The defective Work will be partially repaired to the instructions of the Architect, and the unit price will be adjusted to a new unit price at the discretion of Architect.
- C. The authority of Architect to assess the defect and identify payment adjustment is final.

#### **1.08 SCHEDULE OF UNIT PRICES**

- A. Unit Price 1: Mass Rock removal and disposal off-site.
  - 1. Unit of measurement: cubic yard measured before removal.
  - 2. 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.
  - 3. Include all other related costs in the contract sum.
  - 4. Method of measurement: Quantities will be verified by a soils and materials engineer employed by the Owner.
- B. Unit Price 2: Trench Rock removal and disposal off-site.
  - 1. Unit of measurement: cubic yard measured before removal.
  - 2. 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.
  - 3. Include all other related costs in the contract sum.
  - 4. Method of measurement: Quantities will be verified by a soils and materials engineer employed by the Owner.
- C. Unit Price 3: Unsuitable soils removal and disposal on-site.
  - 1. Unit of measurement: cubic yard measured before removal.
  - 2. Include the following in the unit price:
    - a. Excavation, loading, and transport of all materials.
    - b. Placement and compaction of materials in on-site disposal or fill area.
    - c. Overhead and profit.
  - 3. Include all other related costs in the contract sum.
  - 4. Method of measurement: Quantities will be verified by a soils and materials engineer employed by the Owner based on measured volume of excavation.
- D. Unit Price 4: Unsuitable soils removal and disposal off-site.
  - 1. Unit of measurement: cubic yard measured before removal.
  - 2. 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.
  - 3. Include costs related to removal of rock or unsuitable soil in other Unit Prices.
  - 4. Method of measurement: Quantities will be verified by a soils and materials engineer employed by the Owner based on measured volume of excavation.
- E. Unit Price 5: Replacement of removed rock or unsuitable soils with on-site suitable soil in-place.
  - 1. Unit of measurement: cubic yard of void to be filled.
  - 2. Include the following in the unit price:
    - a. Excavation, loading, transport of suitable soil materials from on-site borrow area.
    - b. Placement and compaction of soil into void remaining from removed rock or unsuitable soil.
    - c. Overhead and profit.

3. Include all other related costs in the contract sum.
  4. Method of measurement: Quantities will be verified by a soils and materials engineer employed by the Owner based on measured volume of void to be filled.
- F. Unit Price 6: Replacement of removed rock or unsuitable soils with off-site suitable soil in-place.
1. Unit of measurement: cubic yard of void to be filled.
  2. Include the following in the unit price:
    - a. Suitable soil materials from contractor's off-site source.
    - b. Excavation, loading, transport, placement and compaction of soil into void remaining from removed rock or unsuitable soil.
    - c. Overhead and profit.
  3. Include all other related costs in the contract sum.
  4. Include costs related to removal of rock or unsuitable soil in other Unit Prices.
  5. 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.
- G. Unit Price 7: Replacement of removed rock or unsuitable soils with Aggregate Base Course in-place:
1. Unit of measurement: cubic yard of void to be filled.
  2. Include the following in the unit price:
    - a. Certified ABC materials from contractor's off-site source.
    - b. Excavation, loading, transport, placement and compaction of ABC into void remaining from removed rock or unsuitable soil.
    - c. Overhead and profit.
  3. Include all other related costs in the contract sum.
  4. Include costs related to removal of rock or unsuitable soil
  5. 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.
- H. Unit Price 8: Replacement of removed rock or unsuitable soils with No. 57 washed stone in-place.
1. Unit of measurement: cubic yard of void to be filled.
  2. Include the following in the unit price:
    - a. Certified #57 washed stone from contractor's off-site source.
    - b. Excavation, loading, transport, placement and compaction of #57 washed stone into void remaining from removed rock or unsuitable soil.
    - c. Overhead and profit.
  3. Include all other related costs in the contract sum.
  4. Include costs related to removal of rock or unsuitable soil in other Unit Prices.
  5. 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.
- I. Unit Price 9: Woven Geo-Textile Fabric in-place.
1. Unit of measurement: square yard of surface to be covered.
  2. Include the following in the unit price:
    - a. Materials and transport to site.
    - b. Unloading, handling, and placement.
    - c. Overhead and profit.
  3. Include all other related costs in the contract sum.
  4. Method of measurement: Quantities will be verified by a soils and materials engineer employed by the Owner based on the area of ground covered by the fabric. Excess and/or overlap shall not be included in the measurement.
- J. Unit Price 10: Biaxial Geo-Grid in-place.
1. Unit of measurement: square yard of surface to be covered.
  2. Include the following in the unit price:
    - a. Materials and transport to site.

- b. Unloading, handling, and placement.
- c. Overhead and profit.
- 3. Include all other related costs in the contract sum.
- 4. Method of measurement: Quantities will be verified by a soils and materials engineer employed by the Owner based on the area of ground covered by the fabric. Excess and/or overlap shall not be included in the measurement.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION 01 2200**

**SECTION 01 2500  
SUBSTITUTION PROCEDURES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Procedural requirements for proposed substitutions.

**1.02 RELATED REQUIREMENTS**

- A. Instructions to Bidders: Restrictions on timing of substitution requests.
- B. Section 01 3000 - Administrative Requirements: Submittal procedures, coordination.
- C. Section 01 6000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

**1.03 DEFINITIONS**

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
  - 1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
    - a. Unavailability.
    - b. Regulatory changes.
  - 2. Substitutions for Convenience: Will not be considered post bid date.

**1.04 REFERENCE STANDARDS**

- A. CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage); Current Edition.
- B. CSI/CSC Form 13.1A - Substitution Request (After the Bidding/Negotiating Phase); Current Edition.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 GENERAL REQUIREMENTS**

- A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
  - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
  - 2. Agrees to provide the same warranty for the substitution as for the specified product.
  - 3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
  - 4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
  - 5. Waives claims for additional costs or time extension that may subsequently become apparent.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
  - 1. Note explicitly any non-compliant characteristics.
- C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
  - 1. Forms indicated in the Project Manual are adequate for this purpose, and must be used.
- D. Limit each request to a single proposed substitution item.
  - 1. Submit an electronic document, combining the request form with supporting data into single document.

### **3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT**

- A. Submittal Time Restrictions:
  - 1. Instructions to Bidders specifies time restrictions and the documents required for submitting substitution requests during the bidding period.
- B. Submittal Form (before award of contract):
  - 1. Submit substitution requests by completing CSI/CSC Form 1.5C - Substitution Request. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

### **3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION**

- A. Submittal Form (after award of contract):
  - 1. Submit substitution requests by completing CSI/CSC Form 13.1A - Substitution Request (After Bidding/Negotiating). See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.
- B. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
- C. Substitutions will not be considered under one or more of the following circumstances:
  - 1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
  - 2. Without a separate written request.

### **3.04 RESOLUTION**

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
- B. Architect will notify Contractor in writing of decision to accept or reject request.

### **3.05 CLOSEOUT ACTIVITIES**

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

**END OF SECTION 01 2500**

**SECTION 01 3000  
ADMINISTRATIVE REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. General administrative requirements.
- B. Preconstruction meeting.
- C. Site mobilization meeting.
- D. Progress meetings.
- E. Construction progress schedule.
- F. Submittals for review, information, and project closeout.
- G. Number of copies of submittals.
- H. Requests for Interpretation (RFI) procedures.
- I. Submittal procedures.

**1.02 RELATED REQUIREMENTS**

- A. General and Supplementary Conditions of the Contract for Construction: Duties of the Contractor.
- B. Section 01 3216 - Construction Progress Schedule: Form, content, and administration of schedules.
- C. Section 01 6000 - Product Requirements: General product requirements.
- D. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.
- E. Section 01 7800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

**1.03 GENERAL ADMINISTRATIVE REQUIREMENTS**

- A. Comply with requirements of Section 01 7000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- B. Make the following types of submittals to Architect:
  - 1. Requests for Interpretation (RFI).
  - 2. Requests for substitution.
  - 3. Shop drawings, product data, and samples.
  - 4. Test and inspection reports.
  - 5. Design data.
  - 6. Manufacturer's instructions and field reports.
  - 7. Applications for payment and change order requests.
  - 8. Progress schedules.
  - 9. Coordination drawings.
  - 10. Correction Punch List and Final Correction Punch List for Substantial Completion.
  - 11. Closeout submittals.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 PRECONSTRUCTION MEETING**

- A. Schedule meeting after Notice of Award.
- B. Attendance Required:
  - 1. Owner.
  - 2. Architect.

3. Contractor.
- C. Agenda:
  1. Execution of Owner-Contractor Agreement.
  2. Submission of executed bonds and insurance certificates.
  3. Distribution of Contract Documents.
  4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
  5. Submission of initial Submittal schedule.
  6. Designation of personnel representing the parties to Contract, Owner, Contractor and Architect.
  7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
  8. Scheduling.
  9. Scheduling activities of the Owner's geotechnical engineer and quality control testing agency.
- D. Record minutes and distribute copies within two days after meeting to participants, with electronic copies to Architect, Owner, participants, and those affected by decisions made.

### **3.02 SITE MOBILIZATION MEETING**

- A. Schedule meeting at the Project site prior to Contractor occupancy.
- B. Attendance Required:
  1. Contractor.
  2. Owner.
  3. Architect.
  4. Contractor's superintendent.
  5. Major subcontractors.
  6. Owner's Testing/Inspection Agency.
- C. Agenda:
  1. Use of premises by Owner and Contractor.
  2. Owner's requirements.
  3. Construction facilities and controls provided by Owner.
  4. Temporary utilities provided by Owner.
  5. Survey and building layout.
  6. Security and housekeeping procedures.
  7. Schedules.
  8. Application for payment procedures.
  9. Procedures for testing.
  10. Procedures for maintaining record documents.
  11. Requirements for start-up of equipment.
  12. Inspection and acceptance of equipment put into service during construction period.
  13. Submission of site logistics plan identifying locations of, but not limited to, the job-site trailer, material lay-down space, etc.
- D. Record minutes and distribute copies within two days after meeting to participants, with electronic copies to Architect, Owner, participants, and those affected by decisions made.

### **3.03 PROGRESS MEETINGS**

- A. Schedule and administer meetings throughout progress of the work at maximum monthly intervals.
- B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required:
  1. Contractor.

2. Owner.
  3. Architect.
  4. Contractor's superintendent.
- D. Agenda:
1. Review minutes of previous meetings.
  2. Review of work progress.
  3. Field observations, problems, and decisions.
  4. Identification of problems that impede, or will impede, planned progress.
  5. Review of submittals schedule and status of submittals.
  6. Review of RFIs log and status of responses.
  7. Review of off-site fabrication and delivery schedules.
  8. Maintenance of progress schedule.
  9. Corrective measures to regain projected schedules.
  10. Planned progress during succeeding work period.
  11. Coordination of projected progress.
  12. Maintenance of quality and work standards.
  13. Effect of proposed changes on progress schedule and coordination.
  14. Other business relating to work.
- E. Record minutes and distribute copies within two days after meeting to participants, with electronic copies to Architect, Owner, participants, and those affected by decisions made.

### **3.04 CONSTRUCTION PROGRESS SCHEDULE - SEE SECTION 01 3216**

### **3.05 REQUESTS FOR INFORMATION (RFI)**

- A. Definition: A request seeking one of the following:
1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
  2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- B. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
1. Prepare a separate RFI for each specific item.
    - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
    - b. Do not forward requests which solely require internal coordination between subcontractors.
  2. Combine RFI and its attachments into a single electronic file. PDF format is preferred.
- C. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
1. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
- D. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
1. Discrete and consecutive RFI number, and descriptive subject/title.
  2. Issue date, and requested reply date.
  3. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).

4. Annotations: Field dimensions and/or description of conditions which have engendered the request.
  5. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
- E. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- F. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
1. Indicate current status of every RFI. Update log promptly and on a regular basis.
  2. Note dates of when each request is made, and when a response is received.
  3. Highlight items requiring priority or expedited response.
  4. Highlight items for which a timely response has not been received to date.
- G. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.
- H. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
  2. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
  3. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

### **3.06 SUBMITTAL SCHEDULE**

- A. Submit to Architect for review a schedule for submittals in tabular format.
1. Submit at the same time as the preliminary schedule specified in Section - 01 3216 - Construction Progress Schedule.
  2. Coordinate with Contractor's construction schedule and schedule of values.
  3. Format schedule to allow tracking of status of submittals throughout duration of construction.
  4. Arrange information to include scheduled date for initial submittal and specification number and title.
  5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
    - a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.
    - b. All material finish and/or color samples shall be submitted prior to Architect making any finish/color selections. Schedule delivery of finish/color samples to allow time for Architect to make selections, Owner to approve finishes/colors, and account for product lead times to avoid delays in delivery and/or construction. Additional contract time will not be given for delays related to untimely delivery of finish/color selection samples.

### **3.07 SUBMITTALS FOR REVIEW**

- A. When the following are specified in individual sections, submit them for review:
  - 1. Product data.
  - 2. Shop drawings.
  - 3. Samples for selection.
  - 4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below.

### **3.08 SUBMITTALS FOR INFORMATION**

- A. When the following are specified in individual sections, submit them for information:
  - 1. Design data.
  - 2. Certificates.
  - 3. Test reports.
  - 4. Inspection reports.
  - 5. Manufacturer's instructions.
  - 6. Manufacturer's field reports.
  - 7. Other types indicated.

### **3.09 SUBMITTALS FOR PROJECT CLOSEOUT**

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 7800 - Closeout Submittals:
  - 1. Project record documents.
  - 2. Operation and maintenance data.
  - 3. Warranties.
  - 4. Bonds.
  - 5. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

### **3.10 NUMBER OF COPIES OF SUBMITTALS**

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
  - 1. After review, produce duplicates.
  - 2. Retained samples will not be returned to Contractor unless specifically so stated.

### **3.11 SUBMITTAL PROCEDURES**

- A. General Requirements:
  - 1. Use a separate transmittal for each item. Provide an individual submittal for each spec section requiring submittals. Submittals combining information for multiple spec sections will be returned without review or comment.
  - 2. Transmit using approved form.
    - a. Use Contractor's form, subject to prior approval by Architect.
  - 3. Sequentially identify each item. For revised submittals use original number and a sequential combination numerical and alphabetical suffix.

4. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
    - a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
  5. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
    - a. Send submittals in electronic format via email to Architect.
  6. Schedule submittals to expedite the Project, and coordinate submission of related items.
    - a. For each submittal for review, allow 14 days excluding delivery time to and from the Contractor.
  7. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
  8. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
  9. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
- B. Product Data Procedures:
1. Submit only information required by individual specification sections.
  2. Collect required information into a single submittal.
  3. Submit concurrently with related shop drawing submittal.
  4. Do not submit (Material) Safety Data Sheets for materials or products.
- C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
  2. Do not reproduce Contract Documents to create shop drawings.
  3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- D. Samples Procedures:
1. Transmit related items together as single package.
  2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

### **3.12 SUBMITTAL REVIEW**

- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
- B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.
- C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
- D. Architect's and consultants' actions on items submitted for review:
1. Authorizing purchasing, fabrication, delivery, and installation:
    - a. "No Exception Taken", or language with same legal meaning.
    - b. "Make Corrections Noted", or language with same legal meaning.
      - 1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
  2. Not Authorizing fabrication, delivery, and installation:
    - a. "Revise and Resubmit".
      - 1) Resubmit revised item, with review notations acknowledged and incorporated.
    - b. "Rejected".
      - 1) Submit item complying with requirements of Contract Documents.

**END OF SECTION 01 3000**

**SECTION 01 3216  
CONSTRUCTION PROGRESS SCHEDULE**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Preliminary schedule.
- B. Construction progress schedule, bar chart type.

**1.02 RELATED SECTIONS**

- A. Section 01 1000 - Summary: Work sequence and occupancy.

**1.03 SUBMITTALS**

- A. Within 10 days after date of Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
- D. Within 10 days after joint review, submit complete schedule.
- E. Submit updated schedule every 30 days.
- F. Submit in PDF format.

**1.04 QUALITY ASSURANCE**

- A. Contractor's Administrative Personnel: 5 years minimum experience in using and monitoring CPM schedules on comparable projects.

**1.05 SCHEDULE FORMAT**

- A. Sheet Size: 11 x 17 inches.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 PRELIMINARY SCHEDULE**

- A. Prepare preliminary schedule in the form of a horizontal bar chart .

**3.02 CONTENT**

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- B. Identify each item by specification section number.
- C. Identify work of separate stages and other logically grouped activities.
- D. Provide sub-schedules to define critical portions of the entire schedule.
- E. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
- F. Indicate delivery dates for owner-furnished products.
- G. Provide legend for symbols and abbreviations used.

**3.03 BAR CHARTS**

- A. Include a separate bar for each major portion of Work or operation.
- B. Identify the first work day of each week.

**3.04 REVIEW AND EVALUATION OF SCHEDULE**

- A. Participate in joint review and evaluation of schedule with Architect at each submittal.
- B. Evaluate project status to determine work behind schedule and work ahead of schedule.

- C. After review, revise as necessary as result of review, and resubmit within 10 days.

### **3.05 UPDATING SCHEDULE**

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
- C. Annotate diagrams to graphically depict current status of Work.
- D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- E. Indicate changes required to maintain Date of Substantial Completion.
- F. Submit reports required to support recommended changes.
- G. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect.

### **3.06 DISTRIBUTION OF SCHEDULE**

- A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

**END OF SECTION 01 3216**

**SECTION 01 4000  
QUALITY REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Submittals.
- B. Quality assurance .
- C. References and standards.
- D. Testing and inspection agencies and services.
- E. Contractor's construction-related professional design services.
- F. Contractor's design-related professional design services.
- G. Control of installation.
- H. Mock-ups.
- I. Tolerances.
- J. Manufacturers' field services.

**1.02 RELATED REQUIREMENTS**

- A. See General and Supplementary General Conditions of the Contract: Shop Drawings, Inspection of the Work, Testing, etc.
- B. Section 01 3000 - Administrative Requirements: Submittal procedures.
- C. Section 01 6000 - Product Requirements: Requirements for material and product quality.

**1.03 DEFINITIONS**

- A. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.
  - 1. Design Services Types Required:
    - a. Construction-Related: Services Contractor needs to provide in order to carry out the Contractor's sole responsibilities for construction means, methods, techniques, sequences, and procedures.
    - b. Design-Related: Design services explicitly required to be performed by another design professional due to highly-technical and/or specialized nature of a portion of the project. Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design.
- B. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

**1.04 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES**

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:
  - 1. Temporary sheeting, shoring, or supports.
  - 2. Temporary scaffolding.
  - 3. Temporary bracing.
  - 4. Temporary hoist(s) and rigging.

**1.05 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES**

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

- B. Base design on performance and/or design criteria indicated in individual specification sections.
  - 1. Submit a Request for Information to Architect if the criteria indicated are not sufficient to perform required design services.
- C. Scope of Contractor's Professional Design Services: Provide for the following items of work:
  - 1. Structural Design of Wood Trusses: As described in Section 06 1753 - Shop-Fabricated Wood Trusses
  - 2. Structural Design: Include physical characteristics, engineering calculations, and resulting dimensional limitations as described in Section 08 4229 - Automatic Entrances.
  - 3. Structural Design: Include physical characteristics, engineering calculations, and resulting dimensional limitations as described in Section 08 4313 - Aluminum-Framed Storefronts.
  - 4. Structural Design: Include calculations for resisting wind loads, anchor locations, loads at points of attachment to building structure, physical characteristics, resulting dimensional limitations as described in Section 08 4413 - Glazed Aluminum Curtain Walls.
  - 5. Structural Design: Include calculations for resisting wind loads, anchor locations, loads at points of attachment to structure, and physical characteristics as described in Section 10 1433 - Illuminated Cabinet Signage.
  - 6. Design of Entrance Canopies and Shade Structures: 13 3400 - Fabricated Engineered Structures.
  - 7. Sprinkler Layout: Coordinate with ceiling installation, detailed pipe layout, and hydraulic calculations as described in Section 21 0000 Fire Protection.
  - 8. Fire Alarm System Design: As described in section 28 3111 - Digital, Addressable Fire Alarm System.

#### **1.06 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Designer's Qualification Statement: Submit for Architect's knowledge as contract administrator, or for Owner's information.
  - 1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services provided by Contractor.
    - a. Full name.
    - b. Professional licensure information.
    - c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.
- C. Design Data: Where drawings or specifications require delegated design submittals, Contractor shall employ and pay for the services of a design professional, licensed to practice in the state where the project is located. Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
  - 1. Include required product data and shop drawings.
  - 2. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
  - 3. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.
- D. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
  - 1. Include:
    - a. Date issued.
    - b. Project title and number.
    - c. Name of inspector.
    - d. Date and time of sampling or inspection.
    - e. Identification of product and specifications section.
    - f. Location in the Project.

- g. Type of test/inspection.
- h. Date of test/inspection.
- i. Results of test/inspection.
- j. Compliance with Contract Documents.
- k. When requested by Architect, provide interpretation of results.
- 2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- E. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
  - 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
  - 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.
- F. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- G. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
  - 1. Submit report within 30 days of observation to Architect for information.
  - 2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
- H. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
  - 1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

#### **1.07 QUALITY ASSURANCE**

- A. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

#### **1.08 REFERENCES AND STANDARDS**

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

### **1.09 TESTING AND INSPECTION AGENCIES AND SERVICES**

- A. As indicated in individual specification sections, Owner or Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- C. Contractor Employed Agency:
  - 1. Laboratory: Authorized to operate in the State in which the Project is located.
  - 2. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

### **PART 2 PRODUCTS - NOT USED**

### **PART 3 EXECUTION**

#### **3.01 CONTROL OF INSTALLATION**

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

#### **3.02 MOCK-UPS**

- A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
- B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
- C. Notify Architect fifteen (15) working days in advance of dates and times when mock-ups will be constructed.
- D. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.
- E. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- F. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- G. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
  - 1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.
  - 2. Make corrections as necessary until Architect's approval is issued.
- H. Architect will use accepted mock-ups as a comparison standard for the remaining Work.

- I. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

### **3.03 TOLERANCES**

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

### **3.04 TESTING AND INSPECTION**

- A. See individual specification sections for testing and inspection required.
- B. Testing Agency Duties:
  - 1. Test samples of mixes submitted by Contractor.
  - 2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
  - 3. Perform specified sampling and testing of products in accordance with specified standards.
  - 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
  - 5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
  - 6. Perform additional tests and inspections required by Architect.
  - 7. Attend preconstruction meetings and progress meetings, as needed.
  - 8. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
  - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
  - 2. Agency may not approve or accept any portion of the Work.
  - 3. Agency may not assume any duties of Contractor.
  - 4. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:
  - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
  - 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
  - 3. Provide incidental labor and facilities:
    - a. To provide access to Work to be tested/inspected.
    - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
    - c. To facilitate tests/inspections.
    - d. To provide storage and curing of test samples.
  - 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
  - 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
  - 6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

### **3.05 MANUFACTURERS' FIELD SERVICES**

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of observer to Architect 30 days in advance of required observations.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

### **3.06 DEFECT ASSESSMENT**

- A. Replace Work or portions of the Work not complying with specified requirements.
- B. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.

**END OF SECTION 01 4000**

## SECTION 014533 - SPECIAL INSPECTIONS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 GENERAL REQUIREMENTS

- A. Special Inspections and Structural Testing shall be in accordance with Chapter 17 of the North Carolina Building Code.
- B. The program of Special Inspection and Structural Testing is a Quality Assurance program intended to ensure that the work is performed in accordance with the Contract Documents
- C. This specification section is intended to inform the Contractor of the Owner's quality assurance program and the extent of the Contractor's responsibilities. This specification section is also intended to notify the Special Inspector, Testing Company/Testing Laboratory, and other Agents of the Special Inspector of their requirements and responsibilities.

#### 1.3 SCHEDULE OF INSPECTIONS AND TESTS

- A. Required inspections and tests are described in the attached Schedule of Special Inspections and in the individual Specification Sections for the items to be inspected or tested.

#### 1.4 QUALIFICATIONS

- A. The Special Inspector shall be a licensed Professional Engineer who is approved by the Structural Engineer of Record (SER) and Building Official.
- B. The Testing Company/Testing Laboratory and individual technicians shall be approved by the Structural Engineer of Record (SER) and Building Official.
- C. The Testing Company/Testing Laboratory shall retain a full-time licensed Professional Engineer on staff who shall certify all test reports. The Engineer shall be responsible for the training of the testing technicians and shall be in responsible charge of the field and laboratory testing operations.
  - 1. Special Inspections of soils and foundations may be performed by inspectors with an education and background in geotechnical engineering in lieu of a background in structural engineering.
  - 2. Technicians performing sampling and testing of concrete shall be ACI certified Concrete Field Testing Technicians-Grade 1.
  - 3. Inspectors performing inspections of concrete work such as inspections of concrete placement, batching, reinforcing placement, curing and protection, may be ACI certified Concrete Construction Inspectors or ICBO certified Reinforced Concrete Special Inspector in lieu of being a licensed P.E. or EIT.

4. Inspectors performing inspections of prestressed concrete work may be ICBO/BOCA/SBCCI certified Prestressed Concrete Special Inspector.
5. Inspectors performing inspections of masonry may be ICBO certified Structural Masonry Special Inspector.
6. Technicians performing visual inspection of welding shall be AWS Certified Welding Inspectors or ICBO certified Structural Steel and Welding Special Inspectors, technicians performing non-destructive testing such as ultrasonic testing, radiographic testing, magnetic particle testing, or dye-penetrant testing shall be certified as an ASNT-TC Level II or Level III technician.
7. Inspectors performing inspections of spray fireproofing may be ICBO certified Spray-Applied Fireproofing Special Inspector.
8. Technicians performing standard tests described by specific ASTM Standards shall have training in the performance of such tests and must be able to demonstrate either by oral or written examination competence for the test to be conducted. They shall be under the supervision of a licensed Professional Engineer and shall not be permitted to independently evaluate test results.

#### 1.5 SUBMITTALS

- A. The Special Inspector and Testing Company/Testing Laboratory shall submit to the SER and Building Official for review a copy of their qualifications which shall include the names and qualifications of each of the individual inspectors and technicians who will be performing inspections or tests.
- B. The Special Inspector and Testing Company/Testing Laboratory shall disclose any past or present business relationship or potential conflict of interest with the Contractor or any of the Subcontractors whose work will be inspected or tested.

#### 1.6 PAYMENT

- A. The Owner shall engage and pay for the services of the Special Inspector, Agents of the Special Inspector or Testing Company/Testing Laboratory.
- B. If any materials which require Special Inspections are fabricated in a plant that is not certified and is not located within 150 miles of the project, the Contractor shall be responsible for the travel expenses of the Special Inspector of Testing Company/Testing Laboratory.
- C. The Contractor shall be responsible for the cost of any retesting or reinspection of work which fails to comply with the requirements of the Contract Documents.

#### 1.7 CONTRACTOR RESPONSIBILITIES

- A. The Contractor shall cooperate with the Special Inspector and his agents so that the Special Inspections and testing may be performed without hindrance.
- B. The Contractor shall review the Statement of Special Inspections and shall be responsible for coordinating and scheduling inspections and tests. The Contractor shall notify the Structural Engineer of Record, Special Inspector or Testing Company/Testing Laboratory at least 48 hours in advance of a required inspection or test. Uninspected work that required inspection may be rejected solely on that basis.

- C. The Contractor shall complete the attached Contractor Statement of Responsibility and submit to owner with the signed contracts.
- D. The Contractor shall provide the form for the Final Report of Special Inspections to the Special Inspector for completion at the completion of the project.
- E. The Statement of Special Inspections will be completed by the Structural Engineer of Record and the Owner and provided to the Contractor after the contracts are signed and returned to the Owner. The Contractor shall submit the completed Statement of Special Inspections to the Building Official for acceptance at the time the building permit is applied for.
- F. The Contractor shall provide incidental labor and facilities to provide access to the work to be inspected or tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, storage and curing of test samples.
- G. The Contractor shall keep at the project site the latest set of construction drawings, field sketches, approved shop drawings, and specifications for use by the inspectors and testing technicians.
- H. The Special Inspection program shall in no way relieve the Contractor of his obligation to perform work in accordance with the requirements of the Contract Documents or from implementing an effective Quality Control program. All work that is to be subjected to Special Inspections shall first be reviewed by the Contractor's quality control personnel.
- I. The Contractor shall be solely responsible for construction site safety.

#### 1.8 LIMITS ON AUTHORITY

- A. The Special Inspector or Testing Company/Testing Laboratory may not release, revoke, alter, or enlarge on the requirements of the Contract Documents.
- B. The Special Inspector or Testing Company/Testing Laboratory will not have control over the Contractor's means or methods of construction.
- C. The Special Inspector or Testing Company/Testing Laboratory shall not be responsible for construction site safety.
- D. The Special Inspector or Testing Company/Testing Laboratory has no authority to stop the work.

#### 1.9 STATEMENT OF SPECIAL INSPECTIONS

- A. The Statement of Special Inspections will be prepared by the Structural Engineer of Record.
- B. The attached Statement of Special Inspections shall be used.
- C. The Statement of Special Inspections shall be provided to the Contractor after the contracts are signed and returned to the Owner and shall be submitted with the application of Building Permit.

#### 1.10 RECORDS AND REPORTS

- A. Detailed daily reports shall be prepared of each inspection or test and submitted to the Special Inspector. Reports shall include:
  - 1. date of test or inspection
  - 2. name of inspector or technician
  - 3. location of specific areas tested or inspected
  - 4. description of test or inspection and results
  - 5. applicable ASTM standard
  - 6. weather conditions
  - 7. Engineer's seal and signature
- B. The Special Inspector shall submit interim reports to the Building Official at the end of each month which include all inspections and test reports received last week. Copies shall be sent to the SER, Architect and Contractor.
- C. Any discrepancies from the Contract Documents found during a Special Inspection shall be immediately reported to the Contractor. If the discrepancies are not corrected, the Special Inspector shall notify the SER and Building Official. Reports shall document all discrepancies identified and the correction action taken.
- D. The Testing Company/Testing Laboratory shall immediately notify the Special Inspector and the SER by telephone, fax or electronic mail any test results which fail to comply with the requirements of the Contract Documents.
- E. Reports shall be submitted to the Special Inspector within 7 days of the inspection or test. Legible hand written reports may be submitted if final typed copies are not readily available. Formal reports shall follow.
- F. At the completion of the work requiring Special Inspections, each inspection agency and Testing Company/Testing Laboratory shall provide a statement to the Special Inspector that all work was completed in substantial conformance with the Contract Documents and that all appropriate inspections and tests were performed.

#### 1.11 FINAL REPORT OF SPECIAL INSPECTIONS

- A. The Final Report of Special Inspections shall be completed by the Special Inspector and submitted to the SER and Building Official prior to the issuance of a Certificate of Use and Occupancy.
- B. The attached Final Report of Special Inspections shall be used.
- C. The Final Report of Special Inspections will certify that all required inspections have performed and will itemize any discrepancies that were not corrected or resolved.

PART 2 - PRODUCTS (not applicable)

PART 3 - EXECUTION (not applicable)

Attached are the following forms:

Pender County Library, Hampstead Branch

1. Statement of Special Inspections
2. Schedule of Special Inspection Services
3. Quality Assurance Plan
4. Qualifications of Inspectors and Testing Technicians
5. Schedule of Special Inspection Services
6. Final Report of Special Inspections
7. Final Report of Special Inspections (Agent's Final Report)
8. Contractor's Statement of Responsibility
9. Fabricator's Certificate of Compliance

END OF SECTION 014533

**Statement of Special Inspections**

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Pender County Library, Hampstead Branch

Project: Pender County Library, Hampstead Branch  
Location: 15146 US HWY 17, Hampstead, NC 28443  
Owner's Representative: Allen Vann, Assistant County Manager  
Owner's Address: 805 S. Walker St, Burgaw, NC 28425

This Statement of Special Inspections is submitted as a condition for permit issuance in accordance with the Special Inspection requirements of the 2018 North Carolina State Building Code. It includes a Schedule of Special Inspection Services applicable to this project, the name of the Special Inspector, the identity of other approved agencies retained for conducting Special Inspections, and the required inspector qualifications. This Statement of Special Inspections was prepared by the following Designers of Record:

Structural	Adam Sisk, PE, SE		
	(Type or print name)	(Signature)	(Date)
Architectural	Jenny Williams, AIA		
	(Type or print name)	(Signature)	(Date)
Mechanical			
	(Type or print name)	(Signature)	(Date)
Other			
	(Type or print name)	(Signature)	(Date)

The Special Inspector shall keep records of all special inspections and tests and shall furnish reports to the State Construction Office and the Designers of Record. Reports shall indicate if the work inspected or tested was or was not completed in conformance with the approved construction documents. Discovered discrepancies shall be brought to the immediate attention of the Contractor for correction. If such discrepancies are not corrected, the discrepancies shall be brought to the attention of the State Construction Office and the Designers of Record. The Special Inspections program does not relieve the Contractor of his or her responsibilities.

Interim reports shall be submitted to the State Construction Office, Owner, and the Designers of Record.

Interim Report Frequency: Monthly

A Final Report of Special Inspections documenting completion of all required Special Inspections, testing, and correction of any discrepancies should be submitted prior to issuance of a Certificate of Use and Occupancy.

Job Site safety and means and methods of construction are solely the responsibility of the Contractor.

Owner's Authorization

Accepted by:

\_\_\_\_\_  
Signature                      Date

\_\_\_\_\_  
Signature                      Date

*Schedule of Special Inspection Services* <sub>a</sub>

The following sheets comprise the required schedule of special inspections for this project. The construction divisions which require special inspections for this project are as follows.

- |   |   |
|---|---|
| <input type="checkbox"/> Structural Steel & High Strength Bolting | <input type="checkbox"/> Helical Pile Foundations                           |
| <input type="checkbox"/> Welding of Structural Steel              | <input type="checkbox"/> Rammed Aggregate Piers & Stone Columns             |
| <input type="checkbox"/> Cold-Formed Steel Deck                   | <input type="checkbox"/> Sprayed Fire-Resistant Material                    |
| <input type="checkbox"/> Open-Web Steel Joists & Joist Girders    | <input type="checkbox"/> Mastic & Intumescent Fire-Resistant Coatings       |
| <input type="checkbox"/> Cold-Formed Steel Framing                | <input type="checkbox"/> Exterior Insulation & Finish System                |
| <input checked="" type="checkbox"/> Concrete Construction         | <input type="checkbox"/> Fire-Resistant Penetrations & Joints               |
| <input type="checkbox"/> Masonry Construction <sub>b</sub>        | <input type="checkbox"/> Smoke Control                                      |
| <input checked="" type="checkbox"/> Wood Construction             | <input type="checkbox"/> Retaining Wall & Systems > 5 Feet                  |
| <input checked="" type="checkbox"/> Soils                         | <input checked="" type="checkbox"/> Special Inspections for Wind Resistance |
| <input type="checkbox"/> Driven Deep Foundations                  | <input type="checkbox"/> Special Inspections for Seismic Resistance         |
| <input type="checkbox"/> Cast-in-Place Deep Foundations           |   |

The inspection frequency indicated on the following inspection tables are "C" continuous, "P" periodic, & "O" random on a daily basis.

Inspection Agents	Firm Name & Point of Contact	Address / Phone / E-mail
1. Special Inspector (SI-1)		
2. Testing Agency (TA-1)		
3. Testing Agency (TA-2)		
4. Geotechnical Engineer (GE-1)	Terracon Justin L. DeNicola, P.E.	2108 Capital Drive Wilmington, NC 28405 910-478-9915
5. Other (O-1)		

Note: The inspection and testing agent(s) shall be engaged by the Owner or the Registered Design Professional of Record acting as the Owner's agent, and not by the Contractor or Sub-contractor whose work is to be inspected or tested. Any conflict of interest must be disclosed to the State Construction Office, prior to commencing work.

Seismic Design Category: ☐ A ☒ B ☐ C ☐ D

Basic Wind Speed ( $V_{asd}$ ): ☐ 90-109mph ☐ 110-119mph ☒  $\geq 120$ mph

Wind Exposure Category: ☐ B ☒ C ☐ D

Schedule of Special Inspection Services  
**Concrete Construction**

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			Standard <sup>a</sup>	NCBC	
1. Inspect reinforcement and verify placement	<input checked="" type="checkbox"/>	P	ACI Ch.20, 25.2, 25.3, 26.6.1-26.6.3	1908.4	
2. Reinforcing Bar Welding:			AWS D1.4		
a. Verify weldability of reinforcing bars other than ASTM A706 and collect reports	<input checked="" type="checkbox"/>	P	ACI 26.6.4	1704.5	
b. Inspect single-pass fillet welds $\leq 5/16"$	<input checked="" type="checkbox"/>	P	ACI 26.6.4		
c. Inspect all welds other than single-pass fillet welds $\leq 5/16"$	<input checked="" type="checkbox"/>	C	ACI 26.6.4		
3. Concrete Anchors:					
a. Inspect anchors cast in concrete	<input checked="" type="checkbox"/>	P	ACI 17.8.2		
b. Inspect adhesive anchors installed in hardened concrete with horizontally or upwardly inclined orientations that resist sustained tension loads	<input checked="" type="checkbox"/>	C	ACI 17.8.2.4		
c. Inspect adhesive anchors installed in hardened concrete with orientations different from Item 3.b	<input checked="" type="checkbox"/>	P	ACI 17.8.2		
d. Inspect mechanical anchors installed in hardened concrete	<input checked="" type="checkbox"/>	P	ACI 17.8.2		
4. Collect mix designs and verify the correct mix used during installation	<input checked="" type="checkbox"/>	P	ACI Ch19, 26.4.3, 26.4.4	1904.1, 1904.2, 1908.2, 1908.3	
5. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete	<input checked="" type="checkbox"/>	C	ASTM C172, ASTM C31, ACI 26.4, 26.12	1908.10	
6. Inspect concrete placement for proper application techniques	<input checked="" type="checkbox"/>	C	ACI 26.5	1908.6, 1908.7, 1908.8	
7. Verify maintenance of specified curing temperature and techniques	<input checked="" type="checkbox"/>	P	ACI 26.5.3-26.5.5	1908.9	
8. Inspect formwork for shape, location and dimensions of the concrete member being formed	<input checked="" type="checkbox"/>	P	ACI 26.11.1.2(b)		
9. Collect mill test reports for ASTM A615 rebar used by SFRS special moment frames, special structural walls or coupling beams	<input checked="" type="checkbox"/>	C	ACI 20.2.2.5	1704.5	

a. References to "ACI" in this table are to the ACI 318-14.

Schedule of Special Inspection Services  
**Soils**

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agents
			Standard	NCBC	
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity	<input checked="" type="checkbox"/>	P		1705.6	
2. Verify excavations extend to proper depth and have reached the correct soil material	<input checked="" type="checkbox"/>	P		1705.6	
3. Perform classification and testing of compacted fill materials	<input checked="" type="checkbox"/>	P		1705.6	
4. Verify that materials used, densities, lift thickness and procedures used during placement and compaction of compacted fill are in accordance with the approved soils report and the construction documents	<input checked="" type="checkbox"/>	C		1705.6	
5. Prior to placement of compacted fill, verify that the subgrade has been prepared in accordance with the approved soils report and the construction documents	<input checked="" type="checkbox"/>	P		1705.6	

Schedule of Special Inspection Services  
**Wood Construction**

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			Standard	NCBC	
1. Fabricator certification / verification of quality control procedures for prefabricated wood structural elements and assemblies					
a. Verify fabricator qualifications	<input checked="" type="checkbox"/>	C		1704.2.5.1, 1705.5	
b. Collect certificates of compliance from the fabricator at completion of fabrication	<input checked="" type="checkbox"/>	C		1704.5, 1705.5	
2. High-load diaphragms				2306.2	
a. Verify that wood structural panel sheathing is the correct grade and thickness	<input type="checkbox"/>	P		1705.5.1	
b. Verify nominal size of framing members and blocking at adjoining panel edges	<input type="checkbox"/>	P	AWC-SDPWS 4.2.7.1.2	1705.5.1	
c. Nail and or staple diameter, length, quantity and spacing comply with the contract documents	<input type="checkbox"/>	P		1705.5.1	
3. For metal-plate-connected trusses clear spanning 60 feet or more, verify that both temporary and permanent restraints and braces are installed in accordance with the approved truss submittal package	<input type="checkbox"/>	P		1705.5.2	
4. Inspect all structural framing for member size, grade, spacing, fastening and connections. Verify floor and roof truss installation with approved shop drawings	<input checked="" type="checkbox"/>	P			
5. Inspect all structural sheathing for thickness, grade, and fastening	<input checked="" type="checkbox"/>	P			
6. Inspect all connections including truss hangers, roof truss holdowns, and shear wall holdown rods	<input checked="" type="checkbox"/>	P			

Schedule of Special Inspection Services  
**Special Inspections for Wind Resistance**

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			Standard	NCBC	
1. Prior to any work taking place, each contractor responsible for the construction of a wind-resisting system or component shall submit a written statement of contractor responsibility	<input checked="" type="checkbox"/>	C		1704.4	
2. Structural Wood					
a. Verify field gluing operations pertinent to the main wind force-resisting system	<input type="checkbox"/>	C		1705.11.1	
b. Inspect nailing, anchoring, and fastening of components within the main windforce-resisting system including shear walls, diaphragms, drag struts, braces & hold-downs	<input checked="" type="checkbox"/>	P		1705.11.1	
4. Wind-resisting components					
a. Inspect the fastening of roof covering, roof deck and supporting roof framing connections	<input checked="" type="checkbox"/>	P		1705.11.3.1	
b. Inspect the fastening of exterior wall coverings & the wall connections to the roof / floor diaphragms & framing members	<input checked="" type="checkbox"/>	P		1705.11.3.2	

Structural Wood and Cold-Formed Steel Light-Frame Construction Main Wind-Force Resisting System(s)  
 Subject to Special Inspections: Wood Diaphragms (roof and mezzanine sheathing). Wood Shear Walls.

Roof Cladding Components and Connections Subject to Special Inspections: Roof Sheathing and  
 Roof Coverings

Wall Cladding Components and Connections Subject to Special Inspections: Wall Sheathing and Wall  
 Coverings

## FINAL REPORT OF SPECIAL INSPECTIONS - STRUCTURAL

Pender County Library, Hampstead Branch

Project: Pender County Library, Hampstead Branch

Location: 15146 US HWY 17, Hampstead, NC 28443

Owner: Pender County

Owner's Address: 805 S. Walker St., Burgaw, NC 28425

Architect of Record: Jenny Williams, AIA

Structural Engineer of Record: Adam Sisk, PE, SE

Comments:

Respectfully submitted,

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Signature

Date

Licensed Professional Seal

## FINAL REPORT OF SPECIAL INSPECTIONS

### AGENT'S FINAL REPORT

Project: Pender County Library, Hampstead Branch

Agent:

Special Inspector:

To the best of my information, knowledge and belief, the Special Inspections or testing required for this project, and designated for this Agent in the *Statement of Special Inspections* submitted for permit, have been performed and all discovered discrepancies have been reported and resolved other than the following:

Comments:

*(Attach continuation sheets if required to complete the description of corrections).*

Interim reports submitted prior to this final report form a basis for and are to be considered an integral part of this final report.

Respectfully submitted,

Agent of the Special Inspector

Licensed Professional Seal

---

Signature

Date

## FABRICATOR'S CERTIFICATE OF COMPLIANCE

Each approved fabricator that is exempt from Special Inspection of shop fabrication and implementation procedures per section 1704.2 of the International Building Code must submit a *Fabricator's Certificate of Compliance* at the completion of fabrication.

Project: Judy Holly Sidbury Hampstead Library

Fabricator's Name:

Address:

Certification or Approval Agency:

Certification Number:

Date of Last Audit or Approval:

Description of structural members and assemblies that have been fabricated:

I hereby certify that items described above were fabricated in strict accordance with the approved construction documents.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Title

Attach copies of fabricator's certification or building code evaluation service report and fabricator's quality control manual.

**SECTION 01 5000**  
**TEMPORARY FACILITIES AND CONTROLS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Dewatering
- B. Temporary utilities.
- C. Temporary telecommunications services.
- D. Temporary sanitary facilities.
- E. Temporary Controls: Barriers, enclosures, and fencing.
- F. Security requirements.
- G. Vehicular access and parking.
- H. Waste removal facilities and services.
- I. Project identification sign.
- J. Field offices.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 5813 - Temporary Project Signage.

**1.03 DEWATERING**

- A. Provide temporary means and methods for dewatering all temporary facilities and controls.
- B. Maintain temporary facilities in operable condition.

**1.04 TEMPORARY UTILITIES**

- A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.
- B. Use trigger-operated nozzles for water hoses, to avoid waste of water.

**1.05 TELECOMMUNICATIONS SERVICES**

- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
- B. Telecommunications services shall include:
  - 1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
  - 2. Internet Connections: Minimum of one; Cable modem or faster.
  - 3. Email: Account/address reserved for project use.

**1.06 TEMPORARY SANITARY FACILITIES**

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Maintain daily in clean and sanitary condition.

**1.07 BARRIERS**

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations.
- B. Provide protection for plants designated to remain. Replace damaged plants.
- C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

**1.08 FENCING**

- A. Construction: Commercial grade chain link fence.

- B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

#### **1.09 EXTERIOR ENCLOSURES**

- A. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons.

#### **1.10 SECURITY**

- A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

#### **1.11 VEHICULAR ACCESS AND PARKING**

- A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- B. Coordinate access and haul routes with governing authorities and Owner.
- C. Provide and maintain access, free of obstructions, to fire hydrants, existing utility well, and existing buildings.
- D. Provide means of removing mud from vehicle wheels before entering streets.
- E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

#### **1.12 WASTE REMOVAL**

- A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.
- B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- C. Provide containers with lids. Remove trash from site periodically.
- D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

#### **1.13 PROJECT SIGNS - SEE SECTION 01 5813**

#### **1.14 FIELD OFFICES**

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture and drawing display table.
- B. Provide space for Project meetings, with table and chairs to accommodate 8 persons.
- C. Locate offices a minimum distance of 30 feet from existing and new structures.

#### **1.15 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS**

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.

### **PART 2 PRODUCTS - NOT USED**

### **PART 3 EXECUTION - NOT USED**

**END OF SECTION 01 5000**

**SECTION 01 5813  
TEMPORARY PROJECT SIGNAGE**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Project identification sign.

**1.02 QUALITY ASSURANCE**

- A. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawing: Show content, layout, lettering, color, structure, sizes and grades of members.

**PART 2 PRODUCTS**

**2.01 SIGN MATERIALS**

- A. Structure and Framing: New, wood, structurally adequate.
- B. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum 1/2 inch thick, standard large sizes to minimize joints.
- C. Rough Hardware: Galvanized.
- D. Paint and Primers: Exterior quality, two coats; white color.
- E. Lettering and Graphics: Pre-cut vinyl self-adhesive products, as indicated on project sign drawing.

**2.02 PROJECT IDENTIFICATION SIGN**

- A. One painted sign of construction, design, and content indicated on drawings, location to be determined in the field.
- B. Graphic Design, Colors, Style of Lettering: Designated by Architect.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

- A. Install project identification sign within 30 days after date fixed by Notice to Proceed.
- B. Erect at designated location.
- C. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.
- D. Install sign surface plumb and level, with butt joints. Anchor securely.
- E. Paint exposed surfaces of sign, supports, and framing.

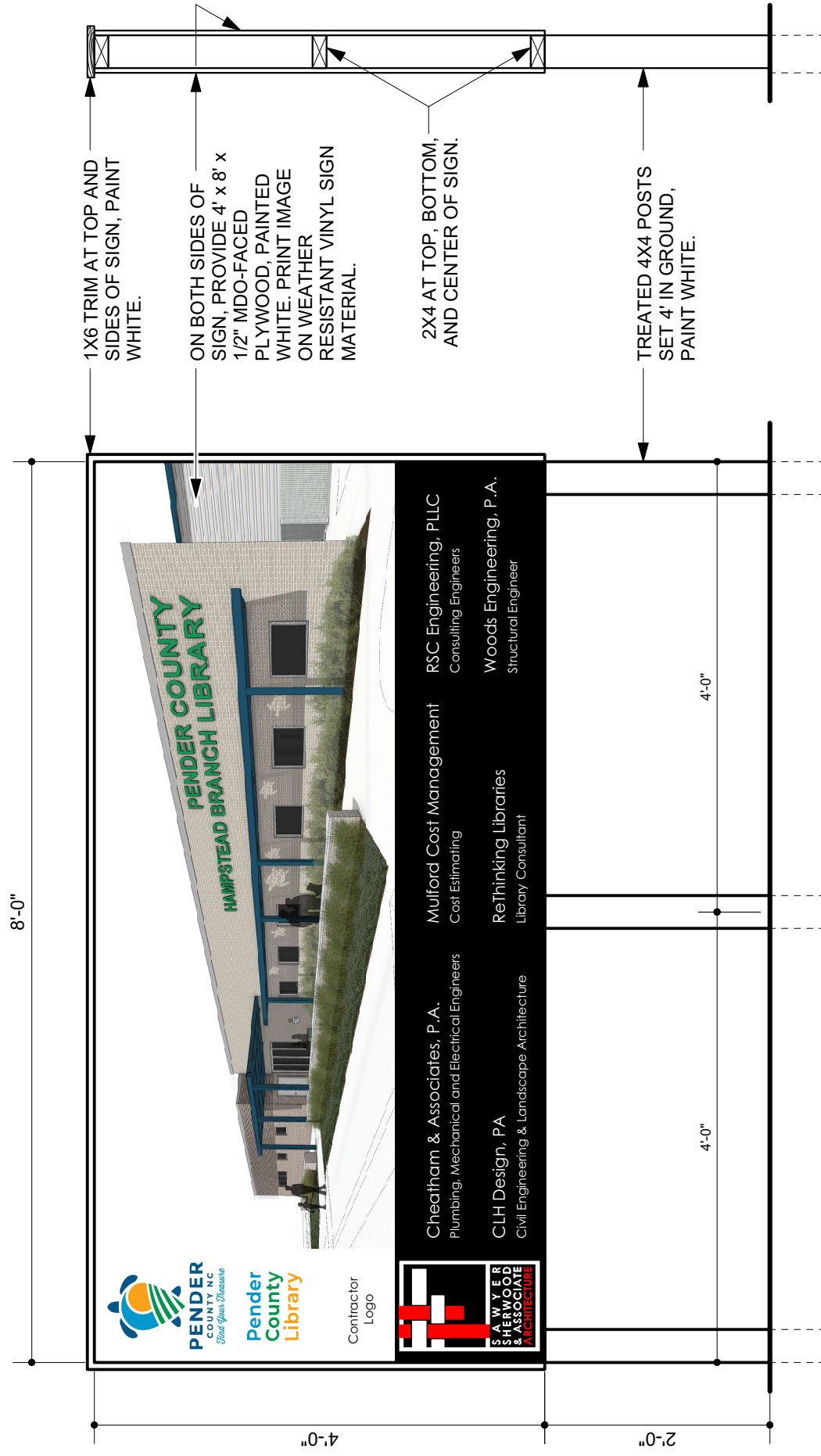
**3.02 MAINTENANCE**

- A. Maintain signs and supports; clean, repair deterioration and damage.

**3.03 REMOVAL**

- A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.

**END OF SECTION 01 5813**



Typical Elevation  
Not to Scale

Section View  
Not to Scale

**SECTION 01 6000  
PRODUCT REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations.
- E. Procedures for Owner-supplied products.
- F. Maintenance materials, including extra materials, spare parts, tools, and software.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 2500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
- B. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

**1.03 SUBMITTALS**

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
  - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

**PART 2 PRODUCTS**

**2.01 NEW PRODUCTS**

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. Use of products having any of the following characteristics is not permitted:
  - 1. Containing lead, cadmium, or asbestos.
- C. Where other criteria are met, Contractor shall give preference to products that:
  - 1. If used on interior, have lower emissions, as defined in Section 01 6116.
  - 2. If wet-applied, have lower VOC content, as defined in Section 01 6116.

**2.02 PRODUCT OPTIONS**

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

**2.03 MAINTENANCE MATERIALS**

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

## **PART 3 EXECUTION**

### **3.01 SUBSTITUTION LIMITATIONS**

- A. See Section 01 2500 - Substitution Procedures.

### **3.02 OWNER-SUPPLIED PRODUCTS**

- A. Owner's Responsibilities:
  - 1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
  - 2. Arrange and pay for product delivery to site.
  - 3. On delivery, inspect products jointly with Contractor.
  - 4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
  - 5. Arrange for manufacturers' warranties, inspections, and service.
- B. Contractor's Responsibilities:
  - 1. Review Owner reviewed shop drawings, product data, and samples.
  - 2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
  - 3. Handle, store, install and finish products.
  - 4. Repair or replace items damaged after receipt.

### **3.03 TRANSPORTATION AND HANDLING**

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

### **3.04 STORAGE AND PROTECTION**

- A. Provide protection of stored materials and products against theft, casualty, or deterioration.
- B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 7419.
  - 1. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor and roof areas.
- C. Store and protect products in accordance with manufacturers' instructions.
- D. Store with seals and labels intact and legible.
- E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.
- F. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- G. For exterior storage of fabricated products, place on sloped supports above ground.

- H. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- I. Comply with manufacturer's warranty conditions, if any.
- J. Do not store products directly on the ground.
- K. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- L. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- M. Prevent contact with material that may cause corrosion, discoloration, or staining.
- N. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- O. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

**END OF SECTION 01 6000**

**SECTION 01 7000  
EXECUTION AND CLOSEOUT REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Examination, preparation, and general installation procedures.
- B. Pre-installation meetings.
- C. Cutting and patching.
- D. Surveying for laying out the work.
- E. Cleaning and protection.
- F. Starting of systems and equipment.
- G. Demonstration and instruction of Owner personnel.
- H. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- I. General requirements for maintenance service.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 1000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. Section 01 7900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections
- C. Section 07 8400 - Firestopping.

**1.03 REFERENCE STANDARDS**

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
  - 1. On request, submit documentation verifying accuracy of survey work.
  - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
  - 3. Submit surveys and survey logs for the project record.
- C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
  - 1. Structural integrity of any element of Project.
  - 2. Integrity of weather exposed or moisture resistant element.
  - 3. Efficiency, maintenance, or safety of any operational element.
  - 4. Visual qualities of sight exposed elements.
  - 5. Work of Owner or separate Contractor.
- D. Project Record Documents: Accurately record actual locations of capped and active utilities.

**1.05 QUALIFICATIONS**

- A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities.

**1.06 PROJECT CONDITIONS**

- A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

- B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- C. Perform dewatering activities, as required, for the duration of the project.
- D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- E. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
  - 1. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

## **1.07 COORDINATION**

- A. See Section 01 1000 for occupancy-related requirements.
- B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- C. Notify affected utility companies and comply with their requirements.
- D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- G. Coordinate completion and clean-up of work of separate sections.
- H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

## **PART 2 PRODUCTS**

### **2.01 PATCHING MATERIALS**

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

### **3.02 PREPARATION**

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

### **3.03 PREINSTALLATION MEETINGS**

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
  - 1. Review conditions of examination, preparation and installation procedures.
  - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

### **3.04 LAYING OUT THE WORK**

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Contractor shall locate and protect survey control and reference points.
- D. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- E. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- F. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- G. Utilize recognized engineering survey practices.
- H. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
  - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
  - 2. Grid or axis for structures.
  - 3. Building foundation, column locations, ground floor elevations.
- I. Periodically verify layouts by same means.
- J. Maintain a complete and accurate log of control and survey work as it progresses.

### **3.05 GENERAL INSTALLATION REQUIREMENTS**

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

- E. Make neat transitions between different surfaces, maintaining texture and appearance.

### **3.06 CUTTING AND PATCHING**

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. Perform whatever cutting and patching is necessary to:
  - 1. Complete the work.
  - 2. Fit products together to integrate with other work.
  - 3. Provide openings for penetration of mechanical, electrical, and other services.
  - 4. Match work that has been cut to adjacent work.
  - 5. Repair areas adjacent to cuts to required condition.
  - 6. Repair new work damaged by subsequent work.
  - 7. Remove samples of installed work for testing when requested.
  - 8. Remove and replace defective and non-complying work.
- C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- D. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- F. Restore work with new products in accordance with requirements of Contract Documents.
- G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.
- I. Patching:
  - 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
  - 2. Match color, texture, and appearance.
  - 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

### **3.07 PROGRESS CLEANING**

- A. Project site is in a prominent location, and it is important to maintain a neat and orderly appearance throughout construction. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition. Maintain landscaping and plantings within construction limits, trim grass and control weeds.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

### **3.08 PROTECTION OF INSTALLED WORK**

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.
- G. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- H. Prohibit traffic from landscaped areas.
- I. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

### **3.09 SYSTEM STARTUP**

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect and Owner seven days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

### **3.10 DEMONSTRATION AND INSTRUCTION**

- A. See Section 01 7900 - Demonstration and Training.

### **3.11 ADJUSTING**

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- B. Testing, adjusting, and balancing HVAC systems: See Section 23 0500 - Heating and Air Conditioning.

### **3.12 FINAL CLEANING**

- A. Use cleaning materials that are nonhazardous.
- B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- E. Clean filters of operating equipment.
- F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
- G. Clean site; sweep paved areas, rake clean landscaped surfaces.

- H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

### **3.13 CLOSEOUT PROCEDURES**

- A. Make submittals that are required by governing or other authorities.
- B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
- E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
- F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

### **3.14 MAINTENANCE**

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

**END OF SECTION 01 7000**

**SECTION 01 7419  
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

**PART 1 GENERAL**

**1.01 WASTE MANAGEMENT REQUIREMENTS**

- A. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- B. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- C. Methods of trash/waste disposal that are not acceptable are:
  - 1. Burning on the project site.
  - 2. Burying on the project site.
  - 3. Dumping or burying on other property, public or private.
  - 4. Other illegal dumping or burying.
- D. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 3000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.
- C. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
- D. Section 01 7000 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

**1.03 DEFINITIONS**

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- I. Return: To give back reusable items or unused products to vendors for credit.
- J. Reuse: To reuse a construction waste material in some manner on the project site.
- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

### **PART 3 EXECUTION**

#### **2.01 WASTE MANAGEMENT PROCEDURES**

- A. See Section 01 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. See Section 01 5000 for additional requirements related to trash/waste collection and removal facilities and services.
- C. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.
- D. See Section 01 7000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

**END OF SECTION 01 7419**

**SECTION 01 7800  
CLOSEOUT SUBMITTALS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Project record documents.
- B. Operation and maintenance data.
- C. Warranties and bonds.

**1.02 RELATED REQUIREMENTS**

- A. General and Supplementary General Conditions of the Contract: Performance bond, labor, and material payment bonds, warranty and correction of work.
- B. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- C. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.
- D. Individual Product Sections: Specific requirements for operation and maintenance data.
- E. Individual Product Sections: Warranties required for specific products or Work.

**1.03 SUBMITTALS**

- A. Project Record Documents: Submit documents markups to Architect for review and use in producing record drawings for the Owner.
- B. Operation and Maintenance Data:
  - 1. Submit electronic copy of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
  - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
  - 3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned prior to Substantial Completion, with Architect comments. Revise content of all document sets as required prior to final submission.
  - 4. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
  - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
  - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
  - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 PROJECT RECORD DOCUMENTS**

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
  - 1. Drawings.
  - 2. Specifications.
  - 3. Addenda.
  - 4. Supplemental Instructions and responses to Requests for Information.
  - 5. Change Orders and other modifications to the Contract.
  - 6. Reviewed shop drawings, product data, and samples.
  - 7. Manufacturer's instruction for assembly, installation, and adjusting.

- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
  - 1. Manufacturer's name and product model and number.
  - 2. Product substitutions or alternates utilized.
  - 3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
  - 1. Measured depths of foundations in relation to finish first floor datum.
  - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
  - 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
  - 4. Field changes of dimension and detail.
  - 5. Details not on original Contract drawings.

### **3.02 OPERATION AND MAINTENANCE DATA**

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

### **3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES**

- A. For Each Product, Applied Material, and Finish:
  - 1. Product data, with catalog number, size, composition, and color and texture designations.
  - 2. Information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional information as specified in individual product specification sections.
- E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

### **3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS**

- A. For Each Item of Equipment and Each System:
  - 1. Description of unit or system, and component parts.
  - 2. Identify function, normal operating characteristics, and limiting conditions.
  - 3. Include performance curves, with engineering data and tests.
  - 4. Complete nomenclature and model number of replaceable parts.

- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- F. Provide servicing and lubrication schedule, and list of lubricants required.
- G. Include manufacturer's printed operation and maintenance instructions.
- H. Include sequence of operation by controls manufacturer.
- I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- J. Provide control diagrams by controls manufacturer as installed.
- K. Include test and balancing reports.
- L. Additional Requirements: As specified in individual product specification sections.

### **3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS**

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
- I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- J. Arrangement of Contents: Organize each volume in parts as follows:
  - 1. Project Directory.
  - 2. Table of Contents, of all volumes, and of this volume.
  - 3. Operation and Maintenance Data: Arranged by system, then by product category.
    - a. Source data.
    - b. Operation and maintenance data.
    - c. Field quality control data.
    - d. Photocopies of warranties and bonds.

### **3.06 WARRANTIES AND BONDS**

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.
- F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
- G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
- H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

**END OF SECTION 01 7800**

**SECTION 01 7900  
DEMONSTRATION AND TRAINING**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Demonstration of products and systems where indicated in specific specification sections.
- B. Training of Owner personnel in operation and maintenance is required for:
  - 1. All software-operated systems.
  - 2. HVAC systems and equipment.
  - 3. Plumbing equipment.
  - 4. Electrical systems and equipment.
  - 5. Landscape irrigation.
  - 6. Items specified in individual product Sections.
- C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
  - 1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
  - 2. Finishes, including flooring, wall finishes, ceiling finishes.
  - 3. Fixtures and fittings.
  - 4. Items specified in individual product Sections.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 7800 - Closeout Submittals: Operation and maintenance manuals.

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
  - 1. Submit to Architect for transmittal to Owner.
  - 2. Submit not less than four weeks prior to start of training.
  - 3. Revise and resubmit until acceptable.
  - 4. Provide an overall schedule showing all training sessions.
  - 5. Include at least the following for each training session:
    - a. Identification, date, time, and duration.
    - b. Description of products and/or systems to be covered.
    - c. Name of firm and person conducting training; include qualifications.
    - d. Intended audience, such as job description.
    - e. Objectives of training and suggested methods of ensuring adequate training.
    - f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
    - g. Media to be used, such as slides, hand-outs, etc.
    - h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
  - 1. Include applicable portion of O&M manuals.
  - 2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
  - 3. Provide one extra copy of each training manual to be included with operation and maintenance data.
- D. Training Reports:
  - 1. Identification of each training session, date, time, and duration.
  - 2. Sign-in sheet showing names and job titles of attendees.

3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.

#### **1.04 QUALITY ASSURANCE**

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
  1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
  2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

### **PART 2 PRODUCTS - NOT USED**

### **PART 3 EXECUTION**

#### **3.01 DEMONSTRATION - GENERAL**

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstration may be combined with Owner personnel training if applicable.
- C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
  1. Perform demonstrations not less than two weeks prior to Substantial Completion.
  2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
  1. Perform demonstrations not less than two weeks prior to Substantial Completion.

#### **3.02 TRAINING - GENERAL**

- A. Conduct training on-site unless otherwise indicated.
- B. Owner will provide classroom and seating at no cost to Contractor.
- C. Provide training in minimum two hour segments.
- D. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.
- E. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
  1. The location of the O&M manuals and procedures for use and preservation; backup copies.
  2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
  3. Typical uses of the O&M manuals.
- F. Product- and System-Specific Training:
  1. Review the applicable O&M manuals.
  2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
  3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
  4. Provide hands-on training on all operational modes possible and preventive maintenance.
  5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.

6. Discuss common troubleshooting problems and solutions.
  7. Discuss any peculiarities of equipment installation or operation.
  8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
  9. Review recommended tools and spare parts inventory suggestions of manufacturers.
  10. Review spare parts and tools required to be furnished by Contractor.
  11. Review spare parts suppliers and sources and procurement procedures.
- G. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

**END OF SECTION 01 7900**

## **SECTION 02 4100 DEMOLITION**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Building demolition excluding removal of hazardous materials and toxic substances.
- B. Selective demolition of built site elements.
- C. Abandonment and removal of existing utilities and utility structures.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 1000 - Summary: Description of items to be salvaged or removed for re-use by Contractor.
- C. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- D. Section 01 6000 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- E. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- F. Section 31 1000 - Site Clearing: Vegetation and existing debris removal; earth stripping and stockpiling.
- G. Section 31 2000 - Earth Moving: Rough and fine grading, fill material for filling holes, pits, and excavations generated as a result of removal operations.
- H. Section 31 2200 - Grading: Rough and fine grading.
- I. Section 31 2323 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

#### **1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Site Plan: Indicate:
  - 1. Areas for temporary construction and field offices.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. Fill Material: See Sections 31 1000 and 31 2000.
- B. Fill Material: See Section 31 2323.

### **PART 3 EXECUTION**

#### **3.01 DEMOLITION**

- A. Remove structures and site features indicated on drawings.
- B. Remove paving and curbs required to accomplish new work.
- C. Remove other items indicated, for salvage, relocation, and recycling.
- D. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as required so that required rough grade elevations do not subside within one year after completion.

### **3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS**

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
  - 1. Obtain required permits.
  - 2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
  - 3. Provide, erect, and maintain temporary barriers and security devices.
  - 4. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
  - 5. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
  - 6. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
  - 7. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.
  - 8. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Do not begin removal until built elements to be salvaged or relocated have been removed.
- D. Do not begin removal until vegetation to be relocated has been removed and vegetation to remain has been protected from damage.
- E. Protect existing structures and other elements to remain in place and not removed.
  - 1. Provide bracing and shoring.
  - 2. Prevent movement or settlement of adjacent structures.
  - 3. Stop work immediately if adjacent structures appear to be in danger.
- F. Minimize production of dust due to demolition operations. Do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- G. Hazardous Materials:
  - 1. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCBs, and mercury.
- H. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

### **3.03 EXISTING UTILITIES**

- A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

#### **3.04 DEBRIS AND WASTE REMOVAL**

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

**END OF SECTION 02 4100**

## SECTION 033000 - CAST-IN-PLACE CONCRETE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
  - 1. Footings.
  - 2. Foundation walls.
  - 3. Slabs-on-grade.
- B. Related Sections:
  - 1. Division 32 for concrete pavement and walks.

#### 1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
  - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
  - 1. Location of construction joints is subject to approval of the Architect.
- E. Samples: For waterstops and vapor retarder.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Welding certificates.
- C. Material Certificates: For each of the following, signed by manufacturers:
  - 1. Cementitious materials.
  - 2. Admixtures.
  - 3. Steel reinforcement and accessories.
  - 4. Bonding agents.
  - 5. Adhesives.
  - 6. Vapor retarders.
  - 7. Semirigid joint filler.
  - 8. Joint-filler strips.
  - 9. Repair materials.
- D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
  - 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- F. Field quality-control reports.
- G. Minutes of preinstallation conference.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. 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."
- C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- 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."
  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.
1. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
    - a. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade I, according to ACI CP-1 or an equivalent certification program.
    - b. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- G. Preinstallation Conference: Conduct conference at Project site.
1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for concrete design mixtures.
    - c. Ready-mix concrete manufacturer.
    - d. Concrete subcontractor.
    - e. Special concrete finish subcontractor.
  2. Review testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.
  3. Review floor finishes to be installed and coordinate with curing methods to be used.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
  - B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

## PART 2 - PRODUCTS

### 2.1 FORM-FACING MATERIALS

- A. 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.

- B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- C. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

## 2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

## 2.3 REINFORCEMENT ACCESSORIES

- A. 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," of greater compressive strength than concrete and as follows:
  - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

## 2.4 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.
- B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
  - 1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
  - 2. CMU Fill Maximum Coarse-Aggregate Size: 3/8 inch nominal.
  - 3. 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.

## 2.5 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.
- C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.
1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Axim Italcementi Group, Inc.; CATEXOL CN-CI
    - b. BASF Construction Chemicals - Building Systems; Rheocrete CNI
    - c. Euclid Chemical Company (The), an RPM company; ARRMATECT, EUCON BCN, or EUCON CIA
    - d. Grace Construction Products, W. R. Grace & Co.; DCI
    - e. Sika Corporation; Sika CNI
- D. Synthetic Macro-Fiber: Polyolefin macro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1 to 2-1/4 inches (25 to 57 mm) long.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Euclid Chemical Company (The), an RPM company; Tuf-Strand SF.
    - b. FORTA Corporation; FORTA FERRO.
    - c. Grace Construction Products, W. R. Grace & Co.; Strux 90/40.
    - d. Nycon, Inc.; XL.
    - e. Propex Concrete Systems Corp.; Fibermesh 650.
    - f. Sika Corporation; Sika Fiber MS.

## 2.6 WATERSTOPS

- A. 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).
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Carlisle Coatings & Waterproofing, Inc.; MiraSTOP.
    - b. CETCO; Volclay Waterstop-RX.
    - c. Concrete Sealants Inc.; Conseal CS-231.
    - d. Greenstreak; Swellstop.
    - e. Henry Company, Sealants Division; Hydro-Flex.
    - f. JP Specialties, Inc.; Earth Shield Type 20.

## 2.7 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape. Maximum perm rating of 0.02.
  - 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. Fortifiber Building Systems Group; Moistop Ultra 15
    - b. Grace Construction Products, W. R. Grace & Co.; Florprufe 120
    - c. Insulation Solutions, Inc.; Viper VaporCheck II
    - d. Meadows, W. R., Inc.; Perminator 15 mil
    - e. Raven Industries Inc.; Vapor Block 15
    - f. Reef Industries, Inc.; Griffolyn 15 mil Green
    - g. Stego Industries, LLC; Stego Wrap 15 mil Class A
  - 2. Provide manufacturer's compatible sealer system for penetrations.
- B. Granular Fill: Provide one of the following:
  - a. Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
  - b. Clean sands with less than 3 percent fines. Materials to be verified by a qualified Geotechnical Engineer.

## 2.8 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
  - 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. BASF Construction Chemicals - Building Systems; Confilm
    - b. ChemMasters; SprayFilm
    - c. Conspec by Dayton Superior; Aquafilm
    - d. Dayton Superior Corporation; Sure Film (J-74)
    - e. Euclid Chemical Company (The), an RPM company; Eucobar
    - f. L&M Construction Chemicals, Inc.; E-CON
    - g. Meadows, W. R., Inc.; EVAPRE
    - h. Sika Corporation; SikaFilm
    - i. Symons by Dayton Superior; Finishing Aid
    - j. Unitex; PRO-FILM
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM 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, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
  - 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. Anti-Hydro International, Inc.; AH Clear Cure WB
    - b. BASF Construction Chemicals - Building Systems; Kure-N-Seal WB
    - c. ChemMasters; Safe-Cure & Seal 20
    - d. Conspex by Dayton Superior; Cure and Seal WB
    - e. Cresset Chemical Company; Crete-Trete 309-VOC Cure & Seal
    - f. Dayton Superior Corporation; Safe Cure and Seal (J-18)
    - g. Euclid Chemical Company (The), an RPM company; Aqua Cure VOX; Clearseal WB 150
    - h. L&M Construction Chemicals, Inc.; Dress & Seal WB
    - i. Meadows, W. R., Inc.; Vocomp-20
    - j. Symons by Dayton Superior; Cure & Seal 18 Percent E

## 2.9 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.
- C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
  - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

## 2.10 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
  - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
  - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
  - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
  - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
  - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
  - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

## 2.11 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
  - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
  - 1. Fly Ash: 25 percent.
  - 2. Combined Fly Ash and Pozzolan: 25 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.
- D. 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.
  - 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

## 2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Proportion normal-weight concrete mixture as follows:
  - 1. Minimum Compressive Strength: 3000 psi at 28 days.
  - 2. Slump Limit: 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
- B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
  - 1. Minimum Compressive Strength – typical interior slab: 3000 psi at 28 days.
  - 2. Minimum Compressive Strength – typical exterior slab: 4000 psi (27.6 MPa) at 28 days.

3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: For exterior broom finished concrete only; 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
6. Synthetic Macro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 3.0 lb/cu. yd. (1.5 kg/cu. m).

## 2.13 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

## 2.14 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
  1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

# PART 3 - EXECUTION

## 3.1 FORMWORK

- A. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- B. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
  1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
- C. Construct forms tight enough to prevent loss of concrete mortar.
- D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
  1. Install keyways, reglets, recesses, and the like, for easy removal.
  2. Do not use rust-stained steel form-facing material.
- E. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- F. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- G. Chamfer exterior corners and edges of permanently exposed concrete.

- H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

### 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.
  - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

### 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. Following leveling and tamping of granular base for slabs on grade, place vapor barrier sheeting with longest dimension parallel with direction of pour and face laps away from the expected direction of the placement whenever possible.
  - 2. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, waterstops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself.
  - 3. Lap joints 6 inches and seal with manufacturer's recommended tape.
  - 4. Apply seam tape to a clean and dry vapor barrier.
  - 5. Seal all penetrations (including pipes) per manufacturer's instructions.
  - 6. Avoid the use of non-permanent stakes driven through vapor retarder.
  - 7. If non-permanent stakes are driven through vapor retarder, repair as recommended by vapor retarder manufacturer.
  - 8. Repair damaged areas with vapor barrier material of similar (or better) permeance, puncture and tensile.

### 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.

- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
  - 1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

### 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.
  - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
  - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
  - 3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- 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. 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- 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.
  - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
  - 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
  - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

### 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. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
  - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. 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. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
  - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
  - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
  - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - 2. Maintain reinforcement in position on chairs during concrete placement.
  - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
  - 4. Slope surfaces uniformly to drains where required.
  - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
  - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

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 or to be covered with a coating or covering material applied directly to concrete.
- C. 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, restraighening, 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 in one direction.
1. Apply scratch finish to surfaces indicated and 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. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces indicated to receive trowel finish.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten 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 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 surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
    - a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or 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.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

### 3.9 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

### 3.10 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 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. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. 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 with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
    - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

### 3.11 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
  - 1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

### 3.12 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.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
  2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
  3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
  2. After concrete has cured at least 14 days, correct high areas by grinding.
  3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
  4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
  5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
  6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
  7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

### 3.13 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.
- B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
  - 1. Steel reinforcement placement.
  - 2. Steel reinforcement welding.
  - 3. Headed bolts and studs.
  - 4. Verification of use of required design mixture.
  - 5. Concrete placement, including conveying and depositing.
  - 6. Curing procedures and maintenance of curing temperature.
  - 7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
  - 1. Testing Frequency: Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, nor less than once for each 150 cu. yd. (114 cu. m) of concrete, nor less than once for each 5,000 sq. ft. of surface area for slabs or walls.
  - 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
  - 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  - 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
  - 5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  - 6. Compression Test Specimens: ASTM C 31/C 31M.
    - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
  - 7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

8. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
  9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
  10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
  11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
  12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

END OF SECTION 033000

**SECTION 03 3511  
CONCRETE FLOOR FINISHES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Liquid densifiers and hardeners.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

**1.03 ADMINISTRATIVE REQUIREMENTS**

**1.04 SUBMITTALS**

- A. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials in manufacturer's sealed packaging, including application instructions.

**PART 2 PRODUCTS**

**2.01 DENSIFIERS AND HARDENERS**

- A. Liquid Densifier and Hardener: Penetrating chemical compound that reacts with concrete, filling the pores, hardening, and dustproofing.
  - 1. Composition: Lithium silicate.
  - 2. Products:
    - a. Dayton Superior Corporation; Pentra-Hard Liquid Densifier: [www.daytonsuperior.com/#sle](http://www.daytonsuperior.com/#sle).
    - b. Euclid Chemical Company; ULTRASIL LI+: [www.euclidchemical.com/#sle](http://www.euclidchemical.com/#sle).
    - c. Hi-Tech Systems; ConDense LS: [www.hitechpolyurea.com/#sle](http://www.hitechpolyurea.com/#sle).
    - d. Kaufman Products Inc; SureHard LS: [www.kaufmanproducts.net/#sle](http://www.kaufmanproducts.net/#sle).
    - e. L&M Construction Chemicals, Inc; LiON HARD: [www.lmcc.com/#sle](http://www.lmcc.com/#sle).
    - f. PROSOCO, Inc; Consolideck LS: [www.prosoco.com/consolideck/#sle](http://www.prosoco.com/consolideck/#sle).
    - g. SpecChem, LLC; LithSeal SC: [www.specchemllc.com/#sle](http://www.specchemllc.com/#sle).
    - h. W. R. Meadows, Inc; Liqui-Hard Ultra: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
    - i. Substitutions: See Section 01 6000 - Product Requirements.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that floor surfaces are acceptable to receive the work of this section.

**3.02 GENERAL**

- A. Apply materials in accordance with manufacturer's instructions.

**3.03 COATING APPLICATION**

- A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.

**END OF SECTION 03 3511**

## **SECTION 04 2000 UNIT MASONRY**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Concrete block.
- B. Clay facing brick.
- C. Mortar and grout.
- D. Reinforcement and anchorage.
- E. Flashings.
- F. Lintels.
- G. Accessories.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 04 7200 - Cast Stone Masonry.
- B. Section 05 1200 - Structural Steel Framing: Structural steel members as indicated on structural drawings.
- C. Section 07 2700 - Air Barriers: Air barriers applied to exterior face of backing sheathing.
- D. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.
- E. Section 07 9100 - Preformed Joint Seals: Sealing open joints in brick veneer.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2023.
- B. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2023.
- C. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.
- D. ASTM C476 - Standard Specification for Grout for Masonry; 2023.
- E. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry; 2019a.
- F. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.
- G. BIA Technical Notes No. 18A - Accommodating Expansion of Brickwork; 2019.
- H. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2017.
- I. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

#### **1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- C. Samples: Submit four samples of each type of facing brick to illustrate color, texture, and extremes of color range.
- D. Color Selection Samples: Submit samples of colored mortar representing manufacturer's full range.

- E. Installer's Qualification Statement.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Brick Units: 50 of each type, size, and color combination.

#### **1.06 QUALITY ASSURANCE**

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience, and holding a current certification as an NCMCA Certified Masonry Contractor.

#### **1.07 MOCK-UPS**

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Construct an L-shaped masonry mock-up panel sized 8 feet long by 4 feet wide by 6 feet high; include mortar, accessories, stud and sheathing backup, reinforcement, window openings, flashings (with lap joint, corner, and end dam), air barrier, waterproofing, and metal wall panels in mock-up. Mockup to include corner condition. Construct sample panel with structural backup and air barrier running full width of panel, and each additional layer (Air barrier, flashings, brick, etc.) constructed a minimum of 8 inches narrower than the layer behind, allowing for observation of appearance of installed condition of each layer. Coordinate with work of other sections in construction of mock-up.
- C. Locate where directed.
- D. Mock-up to remain until brick and metal panel wall finishes are installed on building and accepted by Architect.

#### **1.08 DELIVERY, STORAGE, AND HANDLING**

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

### **PART 2 PRODUCTS**

#### **2.01 CONCRETE MASONRY UNITS**

- A. Concrete Block: Comply with referenced standards and as follows:
  - 1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depth of 8 inches, or as indicated on drawings.
  - 2. Load-Bearing Units: ASTM C90, normal weight.

#### **2.02 BRICK UNITS**

- A. Brick Material Cost: Base bid includes all costs to provide complete masonry systems as specified and indicated on drawings. Cost listed below per thousand brick delivered to jobsite are to establish a level of quality for the brick, and Architect will select bricks within these price ranges after bidding. These brick material and delivery costs are to be used when calculating base bid; all masonry work is included in the base bid.
  - 1. Facing Brick, Color 1:
    - a. Product to be selected by Architect; \$780 per 1000 brick delivered to the jobsite.
    - b. Nominal size: Modular.
    - c. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect. Provide solid units at ends of sloped sills and other locations where cores would otherwise be visible.
  - 2. Facing Brick, Color 2:
    - a. Product to be selected by Architect; \$780 per 1000 brick delivered to the jobsite.
    - b. Nominal size: Modular.

- c. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect. Provide solid units at ends of sloped sills and other locations where cores would otherwise be visible.
- 3. Facing Brick, Color 3:
  - a. Product to be selected by Architect; \$700 per 1000 brick delivered to the jobsite.
  - b. Nominal size: Modular.
  - c. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect. Provide solid units at ends of sloped sills and other locations where cores would otherwise be visible.

## **2.03 CAST STONE UNITS**

- A. See Section 04 7200 - Cast Stone Masonry.

## **2.04 MORTAR AND GROUT MATERIALS**

- A. Water: Clean and potable.
- B. Packaged Dry Material for Mortar for Unit Masonry: Premixed masonry cement and mason sand; complying with ASTM C1714/C1714M and capable of producing mortar of specified strength in accordance with ASTM C270 with addition of water only.
  - 1. Type: Types as scheduled in this section.
  - 2. Color: Mineral pigments added as required to produce approved color sample.
- C. Packaged Dry Material for Grout for Masonry: Premixed cementitious materials and dried aggregates; capable of producing grout of the specified strength in accordance with ASTM C476 with the addition of water only.

## **2.05 REINFORCEMENT AND ANCHORAGE**

- A. Reinforcing Steel: As indicated on structural drawings.
- B. Masonry Veneer Anchors: 2-Piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B. Basis of Design: Hohmann & Barnard, Inc.; DW-10HS: [www.H-B.com](http://www.H-B.com)
  - 1. Anchor Plates: Not less than 0.0785 inch thick.
  - 2. Wire Ties:
    - a. Shape and Thickness: Manufacturer's standard shape, 0.1875 inch thick, minimum.
    - b. Length: Select wire tie length based on cavity thickness to provide 5/8 inch minimum mortar cover.
  - 3. Vertical Adjustment: Not less than 3 inches.
  - 4. Fasteners: Type and length as recommended by manufacturer for backup material.
  - 5. Other Manufacturers:
    - a. Heckmann Building Products: [www.heckmannbuildingprods.com](http://www.heckmannbuildingprods.com).
    - b. Wire-Bond: [www.wirebond.com](http://www.wirebond.com).
    - c. Substitutions: 01 6000 - Product Requirements.

## **2.06 FLASHINGS**

- A. Combination Nonasphaltic Flashing Materials - Copper:
  - 1. Copper/Polymer Film or Fabric Flashing: 3 oz/sq ft copper sheet laminated between two sheets of manufacturer's standard polymer film or fabric. Minimum Puncture Resistance of 780 psi, when measured in accordance with ASTM E154/E154M.
    - a. Manufacturers:
      - 1) Hohmann & Barnard, Inc; Copper-Fabric NA: [www.h-b.com/#sle](http://www.h-b.com/#sle).
      - 2) WIRE-BOND; Copper Seal Flashing: [www.wirebond.com/#sle](http://www.wirebond.com/#sle).
      - 3) York Manufacturing, Inc; Multi-Flash 500 Series: [www.yorkmfg.com/#sle](http://www.yorkmfg.com/#sle).
      - 4) Substitutions: See Section 01 6000 - Product Requirements.
- B. Termination Bars: Aluminum or stainless steel; compatible with membrane and adhesives.
- C. Drip Edge: Stainless steel; angled drip with hemmed edge; compatible with membrane and adhesives.

- D. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

## **2.07 ACCESSORIES**

- A. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
  - 1. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
    - a. Manufacturers:
      - 1) Advanced Building Products, Inc; Mortar Break DT: [www.advancedbuildingproducts.com/#sle](http://www.advancedbuildingproducts.com/#sle).
      - 2) Hohmann & Barnard, Inc; Mortar Trap: [www.h-b.com](http://www.h-b.com).
      - 3) Mortar Net Solutions; WallDefender: [www.mortarnet.com/#sle](http://www.mortarnet.com/#sle).
      - 4) York Manufacturing, Inc; Weep-Net: [www.yorkmfg.com/#sle](http://www.yorkmfg.com/#sle).
      - 5) Substitutions: See Section 01 6000 - Product Requirements.
- B. Weeps and Cavity Vents:
  - 1. Type: Extruded propylene with honeycomb design.
  - 2. Color(s): As selected by Architect from manufacturer's full range.
  - 3. Manufacturers:
    - a. Advanced Building Products, Inc; Weep Vents: [www.advancedbuildingproducts.com/#sle](http://www.advancedbuildingproducts.com/#sle).
    - b. Hohmann & Barnard, Inc; Quadro-Vent: [www.h-b.com/#sle](http://www.h-b.com/#sle).
    - c. Mortar Net Solutions; WeepVent: [www.mortarnet.com/#sle](http://www.mortarnet.com/#sle).
    - d. WIRE-BOND; Cell Vent: [www.wirebond.com/#sle](http://www.wirebond.com/#sle).
- C. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials, as recommended by brick manufacturer.

## **2.08 LINTELS**

- A. See Structural drawings.

## **2.09 MORTAR AND GROUT MIXING**

- A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
  - 1. Exterior, loadbearing masonry: Type S.
  - 2. Exterior, non-loadbearing masonry: Type N.
- B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.
- C. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.
- D. Mixing: Use mechanical batch mixer and comply with referenced standards.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

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

### **3.02 PREPARATION**

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

### **3.03 COLD AND HOT WEATHER REQUIREMENTS**

- A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

### **3.04 COURSING**

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
  - 1. Bond: Running.
  - 2. Coursing: One unit and one mortar joint to equal 8 inches.
  - 3. Mortar Joints: Concave.
- D. Brick Units:
  - 1. Bond: Running.
  - 2. Coursing: Three units and three mortar joints to equal 8 inches.
  - 3. Mortar Joints: Concave.

### **3.05 PLACING AND BONDING**

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Remove excess mortar and mortar smears as work progresses.
- C. Interlock intersections and external corners.
- D. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- E. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

### **3.06 WEEPS/CAVITY VENTS**

- A. Install weeps in veneer and cavity walls at 24 inches on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.
- B. Install cavity vents in veneer and cavity walls at 32 inches on center horizontally below shelf angles and lintels and near top of walls.

### **3.07 CAVITY MORTAR CONTROL**

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
- B. Where scheduled and as indicated on drawings, install cavity mortar control panels continuously throughout full height of exterior masonry cavities during construction of exterior wythe.
- C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

### **3.08 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER**

- A. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches on center vertically and 16 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.
- B. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 16 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

### **3.09 MASONRY FLASHINGS**

- A. Typical conditions, whether or not specifically indicated on drawings:
  - 1. Install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

- a. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up flashing ends at least 1 inch, minimum, to form watertight pan at nonmasonry construction.
  - b. Remove or cover protrusions or sharp edges that could puncture flashings.
  - c. Seal lapped ends and penetrations of flashing before covering with mortar.
- 2. Terminate flashing up 8 inches minimum on vertical surface of backing:
  - a. Install vertical leg of flashing behind water-resistive barrier sheet over backing.
  - b. Anchor vertical leg of flashing into backing with a termination bar and sealant.
- 3. Install flashing in accordance with manufacturer's instructions and BIA Technical Notes No. 7.
- 4. Extend metal flashings to within 1/2 inch of exterior face of masonry and adhere to top of stainless steel angled drip with hemmed edge.
- 5. Support flexible flashings across gaps and openings.
- 6. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

### **3.10 LINTELS**

- A. See structural drawings.

### **3.11 GROUTED COMPONENTS**

- A. At bottom of wall, grout below through-wall flashing. Slope grout to provide positive drainage of through-wall flashing to weep vents.
- B. Reinforce grouted concrete masonry units as indicated on structural drawings.
- C. Place and consolidate grout fill without displacing reinforcing.

### **3.12 CONTROL AND EXPANSION JOINTS**

- A. Do not continue horizontal joint reinforcement through control or expansion joints.
- B. Size control joints as indicated on drawings; if not indicated, 1/2 inch wide.
- C. Where control joints align with edge of wall openings with veneer supported by loose lintels, provide horizontal control joints per BIA Technical Notes No. 18A, Figure 5 (a) & (b).

### **3.13 BUILT-IN WORK**

- A. Install built-in items plumb, level, and true to line.
- B. Do not build into masonry construction organic materials that are subject to deterioration.

### **3.14 TOLERANCES**

- A. Install masonry within the site tolerances found in TMS 402/602.

### **3.15 CUTTING AND FITTING**

- A. Cut and fit for pipes, conduit, sleeves, and other penetrations. Coordinate with other sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

### **3.16 CLEANING**

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

### **3.17 PROTECTION**

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

### 3.18 SCHEDULES

- A. Library Building, Exterior Walls - See drawings for extents of brick veneer.
  - 1. Brick veneer over stud backup.
  - 2. Cavity Mortar Control: Cavity mortar diverter at base of cavity, and at all locations with through-wall flashing and weeps.
  - 3. Veneer Color: Color 1 and Color 2, see drawings for extents of each color.
  - 4. Mortar: Type N, colored.
- B. Vehicle Barrier Wall:
  - 1. Brick veneer over cast-in-place concrete backup.
  - 2. Cast stone wall cap - See Section 04 7200.
  - 3. Cavity Mortar Control: Continuous cavity mortar control panels above through-wall flashing.
  - 4. Veneer Color: Color 1
  - 5. Mortar: Type N, colored.
- C. Monument Sign:
  - 1. Brick veneer over CMU backup.
  - 2. Cast stone wall cap - See Section 04 7200.
  - 3. Cavity Mortar Control: Continuous cavity mortar control panels above through-wall flashing.
  - 4. Veneer Color: Color 3
  - 5. Mortar:
    - a. CMU: Type S, gray.
    - b. Brick Veneer: Type N, colored.

**END OF SECTION 04 2000**

**SECTION 04 7200  
CAST STONE MASONRY**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Architectural cast stone.
- B. Units required are:
  - 1. Exterior wall units, including wall caps.

**1.02 RELATED REQUIREMENTS**

- A. Section 04 2000 - Unit Masonry: Installation of cast stone in conjunction with masonry.
- B. Section 07 9200 - Joint Sealants: Sealing joints indicated to be left open for sealant.

**1.03 REFERENCE STANDARDS**

- A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).
- B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.
- C. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2024.
- D. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement; 2025.
- E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2024.
- F. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2023.
- G. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.
- H. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.
- I. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2024.
- J. ASTM C1364 - Standard Specification for Architectural Cast Stone; 2023, with Editorial Revision (2024).

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Test results of cast stone components made previously by the manufacturer.
- C. Shop Drawings: Include, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.
- D. Color Selection Samples: Physical samples showing manufacturer's standard color range of cast stone and mortar color.
- E. Verification Samples: Pieces of actual cast stone components not less than \_\_\_\_ inches square, illustrating range of color and texture to be anticipated in components furnished for the project.
- F. Manufacturer's Qualification Data: Documentation showing compliance with specified requirements.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications:
  - 1. A firm with a minimum of 5 years experience producing cast stone of types required for project.
  - 2. Current producer member of the Cast Stone Institute or the Architectural Precast Association.

3. Adequate plant capacity to furnish quality, sizes, and quantity of cast stone required without delaying progress of the work.

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

- A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.
- B. Number each piece individually to match shop drawings and schedule.
- C. Store cast stone components and installation materials in accordance with manufacturer's instructions.
- D. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.
- E. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.
- F. Store mortar materials where contamination can be avoided.
- G. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Architectural Cast Stone:
  1. Any current producer member of the Architectural Precast Association.
  2. Any current producer member of the Cast Stone Institute.

#### **2.02 ARCHITECTURAL CAST STONE**

- A. Cast Stone: Architectural concrete product manufactured to simulate appearance of natural stone, complying with ASTM C1364.
  1. Compressive Strength: As specified in ASTM C1364; calculate strength of pieces to be field cut at 80 percent of uncut piece.
  2. Freeze-Thaw Resistance: Demonstrated by laboratory testing in accordance with ASTM C1364.
  3. Surface Texture: Fine grained texture, with no bugholes, air voids, or other surface blemishes visible from distance of 20 feet.
  4. Color: Selected by Architect from manufacturer's standard range.
  5. Remove cement film from exposed surfaces before packaging for shipment.
- B. Shapes: Provide shapes indicated on drawings.
  1. Variation from Any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch or length divided by 360, whichever is greater, but not more than 1/4 inch.
  2. Provide:
    - a. Wash or slope of 1:12 on exterior horizontal surfaces.
    - b. Drips on projecting components.
- C. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI CODE-318.
  1. Pieces More than 24 inches in Any Dimension: Provide full length two-way reinforcement of cross-sectional area not less than 0.25 percent of unit cross-sectional area.

#### **2.03 MATERIALS**

- A. Portland Cement: ASTM C150/C150M.
  1. For Units: Type I or II, gray.
  2. For Mortar: Type I or II, except Type III may be used in cold weather.
- B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.
- C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.

- D. Admixtures: ASTM C494/C494M.
- E. Water: Potable.
- F. Reinforcing Bars: ASTM A615/A615M, Grade 40 (40,000 psi), deformed bars, galvanized.
  - 1. Galvanized in accordance with ASTM A767/A767M, Class I.
- G. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, epoxy coated.
- H. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.
- I. Mortar: Portland cement-lime, ASTM C270 Type N ; do not use masonry cement.
- J. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine construction to receive cast stone components. Notify Architect if construction is not acceptable.
- B. Do not begin installation until unacceptable conditions have been corrected.

### **3.02 INSTALLATION**

- A. Install cast stone components in conjunction with masonry, complying with requirements of Section 04 2000.
- B. Setting:
  - 1. Drench cast stone components with clear, running water immediately before installation.
  - 2. Set units in a full bed of mortar unless otherwise indicated.
  - 3. Fill vertical joints with mortar.
  - 4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

### **3.03 TOLERANCES**

- A. Joints: Make all joints 3/8 inch, except as otherwise detailed.
  - 1. Rake mortar joints 3/4 inch for pointing.
  - 2. Remove excess mortar from face of stone before pointing joints.
  - 3. Point joints with mortar in layers 3/8 inch thick and tool to a slight concave profile.
  - 4. Leave the following joints open for sealant:
    - a. Head joints in top courses, including copings, parapets, cornices, sills, and steps.
    - b. Joints in projecting units.
    - c. Joints between rigidly anchored units, including soffits, panels, and column covers.
    - d. Joints below lugged sills and stair treads.
    - e. Joints below ledge and relieving angles.
    - f. Joints labeled "expansion joint".
- B. Installation Tolerances:
  - 1. Variation from Plumb: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet or more.
  - 2. Variation from Level: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet, or 3/8 inch maximum.
  - 3. Variation in Joint Width: Not more than 1/8 inch in 36 inches or 1/4 of nominal joint width, whichever is less.
  - 4. Variation in Plane Between Adjacent Surfaces (Lipping): Not more than 1/16 inch difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

### **3.04 REPAIR**

- A. Repair chips and other surface damage noticeable when viewed in direct daylight at 20 feet.
- B. Repair with matching touch-up material provided by the manufacturer and in accordance with manufacturer's instructions.
- C. Repair methods and results subject to Architect 's approval.

### **3.05 CLEANING**

- A. Clean completed exposed cast stone after mortar is thoroughly set and cured.
  - 1. Wet surfaces with water before applying cleaner.
  - 2. Apply cleaner to cast stone in accordance with manufacturer's instructions.
  - 3. Remove cleaner promptly by rinsing thoroughly with clear water.
  - 4. Do not use acidic cleaners.

### **3.06 PROTECTION**

- A. Protect completed work from damage.
- B. Clean, repair, or restore damaged or mortar-splashed work to condition of new work.

**END OF SECTION 04 7200**

## SECTION 051200 - STRUCTURAL STEEL FRAMING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Structural steel.
  - 2. Grout.
- B. Related Sections:
  - 1. Section 01 4000 "Quality Requirements" for independent testing agency procedures and administrative requirements.
  - 2. Section 09 9113 "Exterior Painting" for surface-preparation and priming requirements.

#### 1.3 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

#### 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, including comprehensive engineering analysis by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.
  - 1. Select and complete connections using schematic details indicated and AISC 360.
  - 2. Use LRFD; data are given at factored-load level.
- B. Construction: Steel Braced Frames Sign posts, supports for louvered equipment screen, and canopy connections at walls

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
  - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  - 2. Include embedment drawings.
  - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
  - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts.
  - 5. Identify demand critical welds.

6. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  7. Indicate venting and drainage holes for galvanizing using standards of American Galvanizers Association. For vent and drainage holes in members that penetrate building envelope, indicate that holes shall be plugged weathertight.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:
1. Power source (constant current or constant voltage).
  2. Electrode manufacturer and trade name, for demand critical welds.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer, fabricator, professional engineer and testing agency.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural steel, including chemical and physical properties.
- E. Product Test Reports: For the following:
  1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
  2. Shop primers.
  3. Nonshrink grout.
- F. Source quality-control reports.

#### 1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
- D. Comply with applicable provisions of the following specifications and documents:
  1. AISC 303.
  2. AISC 341 and AISC 341s1.
  3. AISC 360.
  4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- E. Preinstallation Conference: Conduct conference at Project site.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
  - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
  - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
  - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
  - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

## 1.9 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

## PART 2 - PRODUCTS

### 2.1 STRUCTURAL-STEEL MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. W-Shapes: ASTM A 992/A 992M.
- C. Channels and Angles: ASTM A 36/A 36M.
- D. Plate and Bar: ASTM A 36/A 36M.
- E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
- F. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
  - 1. Weight Class: Standard unless noted otherwise.
  - 2. Finish: Black except where indicated to be galvanized.
- G. Welding Electrodes: Comply with AWS requirements.

### 2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH, (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers with plain finish.
- C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- D. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
  - 1. Configuration: Straight.
  - 2. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
  - 3. Plate Washers: ASTM A 36/A 36M carbon steel.
  - 4. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
  - 5. Finish: Plain.
- E. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.
  - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
  - 2. Plate Washers: ASTM A 36/A 36M carbon steel.
  - 3. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
  - 4. Finish: Plain.
- F. Threaded Rods: ASTM A 36/A 36M.
  - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
  - 2. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
  - 3. Finish: Plain.

## 2.3 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- B. Galvanizing Repair Paint: ASTM A 780.

## 2.4 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and 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 360.
  - 1. Camber structural-steel members where indicated.
  - 2. Fabricate beams with rolling camber up.
  - 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.

4. Mark and match-mark materials for field assembly.
  5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning."
- 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/D1.1M and manufacturer's written instructions.
- G. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches o.c. unless otherwise indicated.
- H. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
  2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
  3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

## 2.6 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/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

## 2.7 SOURCE QUALITY CONTROL

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. The Fabricator shall be a designated AISC-Certified Plant, Category STD or the Fabricator at their expense shall engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports, this expense shall be added to the Non-Certified Fabricator's bid.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- C. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- D. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- E. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
  1. Liquid Penetrant Inspection: ASTM E 165.
  2. 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.
  3. Ultrasonic Inspection: ASTM E 164.
  4. Radiographic Inspection: ASTM E 94.

## 2.8 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
  1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
  2. Surfaces to be field welded.
  3. 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."
  2. SSPC-SP 3, "Power 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 minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

## 2.9 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 and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
  2. Galvanize all building columns, lintels and shelf angles after fabrication.
  3. Provide venting and drainage holes using standards of American Galvanizers Association.
  4. For members that penetrate building envelope, plug all venting and drainage holes weathertight.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
  - 1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

### 3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Weld plate washers to top of baseplate, where indicated.
  - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
  - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- 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 that form 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. Do not use thermal cutting during erection.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

- H. 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/D1.1M 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 unless otherwise indicated.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
  - 2. Remove backing bars or runoff tabs where indicated, 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 in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

### 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Bolted Connections: 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/D1.1M.
  - 1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M 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/D1.1M 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/D1.1M.
- E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

### 3.6 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.
- B. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

END OF SECTION 051200

## **SECTION 05 5133 METAL LADDERS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Prefabricated ship ladders.

#### **1.02 REFERENCE STANDARDS**

- A. 29 CFR 1910.23 - Ladders; Current Edition.
- B. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008 (Reaffirmed 2018).

#### **1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
  - 1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

### **PART 2 PRODUCTS**

#### **2.01 PREFABRICATED LADDERS**

- A. Prefabricated Ship Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
  - 1. Components: Manufacturer's standard rails, rungs, treads, handrails. returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
  - 2. Materials: Aluminum.
  - 3. Incline: 70 degrees.
  - 4. Finish: Mill finish aluminum.
  - 5. Manufacturers:
    - a. Alaco Ladder Company; H70: [www.alacoladder.com](http://www.alacoladder.com).
    - b. O'Keefe's Inc; 70 Degree Ships Ladder to Roof Hatch: [www.okeeffes.com/#sle](http://www.okeeffes.com/#sle).
    - c. Precision Ladders, LLC; Aluminium Ship Stairs: [www.precisionladders.com/#sle](http://www.precisionladders.com/#sle).
    - d. Thompson Fabricating, LLC; TUFladder-SL, 70 Degree: [www.tfco.com](http://www.tfco.com).
    - e. Substitutions: See Section 01 6000 - Product Requirements.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive work.

#### **3.02 INSTALLATION**

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Obtain approval prior to site cutting or making adjustments not scheduled.

**END OF SECTION 05 5133**

## SECTION 061000 - ROUGH CARPENTRY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Framing with dimension lumber.
  - 2. Framing with timber / glulams.
  - 3. Framing with engineered wood products.
  - 4. Wood blocking, cants, and nailers.
  - 5. Hardwood Sleepers.
  - 6. Utility shelving.
  - 7. Plywood backing panels.
- B. Related Sections include the following:
  - 1. Division 06 Section "Sheathing."
  - 2. Division 06 Section "Shop-Fabricated Wood Trusses" for wood trusses made from dimension lumber.

#### 1.3 DEFINITIONS

- A. Exposed Framing: Framing not concealed by other construction.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
  - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
  - 2. NLGA: National Lumber Grades Authority.
  - 3. RIS: Redwood Inspection Service.
  - 4. SPIB: The Southern Pine Inspection Bureau.
  - 5. WCLIB: West Coast Lumber Inspection Bureau.
  - 6. WWPA: Western Wood Products Association.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
  - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.

2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
  3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
1. Wood-preservative-treated wood.
  2. Power-driven fasteners.
  3. Powder-actuated fasteners.
  4. Expansion anchors.
  5. Metal framing anchors.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.
- B. Manufacturer Qualifications: Provide factory-glued structural units produced by an AITC- or APA-licensed firm.
1. Factory mark each piece of structural glued-laminated timber with AITC Quality Mark or APA-EWS trademark. Place mark on surfaces that will not be exposed in the completed Work.
- C. Quality Standard: Comply with AITC A190.1.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

#### 1.7 MOCK-UPS

- A. See Section 01 4000 – Quality Requirements for additional requirements.
- B. Construct a mock-up as specified in Section 02 4000 – Unit Masonry. Coordinate with work of other sections in construction of mock-up.
- C. Locate where directed.

### PART 2 - PRODUCTS

#### 2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency

certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
  2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
  3. 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.
  4. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

## 2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPAC2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPAC31 with inorganic boron (SBX).
1. Preservative Chemicals: Acceptable to authorities having jurisdiction.
  2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- D. Application: Treat items indicated on Drawings, and the following:
1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
  2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
  3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
  4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
  5. Wood floor plates that are installed over concrete slabs-on-grade.
  6. Hardwood floor sleepers.

## 2.3 DIMENSION LUMBER FRAMING

### A. Non-Load-Bearing Interior Partitions: No. 2 grade or better.

1. Application: All interior partitions.
2. Species:
  - a. Hem-fir (north); NLGA.
  - b. Mixed southern pine; SPIB.
  - c. Spruce-pine-fir; NLGA.
  - d. Hem-fir; WCLIB, or WWPA.
  - e. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
  - f. Northern species; NLGA.
  - g. Eastern softwoods; NeLMA.
  - h. Western woods; WCLIB or WWPA.

### B. Load-Bearing Partitions: No. 2 grade or better.

1. Application: Exterior walls and interior load-bearing partitions.
2. Species:
  - a. Hem-fir (north); NLGA.
  - b. Southern pine; SPIB.
  - c. Douglas fir-larch; WCLIB or WWPA.
  - d. Mixed southern pine; SPIB.
  - e. Spruce-pine-fir; NLGA.
  - f. Douglas fir-south; WWPA.
  - g. Hem-fir; WCLIB or WWPA.
  - h. Douglas fir-larch (north); NLGA.

### C. Ceiling Joists: No. 2 grade or better.

1. Species:
  - a. Hem-fir (north); NLGA.
  - b. Southern pine; SPIB.
  - c. Douglas fir-larch; WCLIB or WWPA.
  - d. Douglas fir-larch (north); NLGA.
  - e. Mixed southern pine; SPIB.
  - f. Spruce-pine-fir; NLGA.
  - g. Hem-fir; WCLIB or WWPA.
  - h. Douglas fir-south; WWPA.
  - i. Northern species; NLGA.
  - j. Eastern softwoods; NeLMA.
  - k. Western woods; WCLIB or WWPA.

### D. Joists, Rafters, and Other Framing Not Listed Above: No. 2 grade or better.

1. Species:

- a. Hem-fir (north); NLGA.
  - b. Southern pine; SPIB.
  - c. Douglas fir-larch; WCLIB or WWPA.
  - d. Mixed southern pine; SPIB.
  - e. Spruce-pine-fir; NLGA.
  - f. Douglas fir-south; WWPA.
  - g. Hem-fir; WCLIB or WWPA.
  - h. Douglas fir-larch (north); NLGA.
- E. Exposed Framing: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.
- 1. Application: Exposed exterior and interior framing.
  - 2. Species and Grade: As indicated above for load-bearing construction of same type.
- F. Maximum Moisture Content: 15 percent.

## 2.4 STRUCTURAL GLUED-LAMINATED TIMBER

- A. General: Provide structural glued-laminated timber that complies with AITC 117 or research/evaluation reports acceptable to authorities having jurisdiction.
- 1. Provide structural glued-laminated timber made from single species.
  - 2. Provide structural glued-laminated timber made from solid lumber laminations; do not use laminated veneer lumber.
  - 3. Provide structural glued-laminated timber made with wet-use adhesive complying with AITC A190.1.
  - 4. Adhesive shall not contain urea-formaldehyde resins.
- B. Species and Grades for Structural Glued-Laminated Timber: Southern pine, 24F-1.9E.
- C. Lay-up: Balanced unless otherwise noted.
- D. Semi Transparent Staining of the Glued Laminated, to be Done by Manufacturer. Color to match Architect's selection.

## 2.5 SOLID-SAWN WOOD DECKING

- A. Decking Species: Southern Pine
- B. Decking Nominal Size: 2x6.
- C. Decking Grade: Dense Select Decking.
- D. Grade Stamps: Factory mark each item with grade stamp of grading agency. Apply grade stamp to surfaces that will not be exposed to view.
- E. Face Surface: Smooth.

- F. Edge Pattern: Tongue and Groove.
- G. Semi Transparent staining of Sawn Roof Deck to be done by Manufacturer, Color to match Arch Selection.

## 2.6 ENGINEERED WOOD PRODUCTS

- A. Engineered Wood Products, General: Products shall contain no urea formaldehyde.
- B. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.
- C. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Boise Cascade Corporation.
    - b. Finnforest USA.
    - c. Georgia-Pacific.
    - d. Jager Building Systems Inc.
    - e. Louisiana-Pacific Corporation.
    - f. Pacific Woodtech Corporation.
    - g. Roseburg Forest Products Co.
    - h. Standard Structures Inc.
    - i. Stark Truss Company, Inc.
    - j. West Fraser Timber Co., Ltd.
    - k. Weyerhaeuser Company.
  - 2. Extreme Fiber Stress in Bending, Edgewise: 2950 psi (20.0 MPa).
  - 3. Modulus of Elasticity, Edgewise: 2,000,000 psi (13 700 MPa).
- D. Laminated-Strand Lumber: Structural composite lumber made by pressing together long, thin strands of wood, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559. ASTM D 7247 is a test method for evaluating the shear strength of adhesive bonds.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Boise Cascade Corporation.
    - b. Finnforest USA.
    - c. Georgia-Pacific.
    - d. Jager Building Systems Inc.
    - e. Louisiana-Pacific Corporation.
    - f. Pacific Woodtech Corporation.
    - g. Roseburg Forest Products Co.

- h. Standard Structures Inc.
  - i. Stark Truss Company, Inc.
  - j. West Fraser Timber Co., Ltd.
  - k. Weyerhaeuser Company.
- 2. Extreme Fiber Stress in Bending: 1700 psi.
  - 3. Modulus of Elasticity: 1,300,000 psi.

## 2.7 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
  - 1. Blocking.
  - 2. Nailers.
  - 3. Rooftop equipment bases and support curbs.
  - 4. Cants.
  - 5. Furring.
  - 6. Grounds.
  - 7. Utility shelving.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 15 percent maximum moisture content of any species.
- C. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:
  - 1. Mixed southern pine, No. 2 grade; SPIB.
  - 2. Hem-fir or hem-fir (north), Construction or 2 Common] grade; NLGA, WCLIB, or WWPA.
  - 3. Spruce-pine-fir (south) or spruce-pine-fir, Construction or 2 Common; NeLMA, NLGA, WCLIB, or WWPA.
- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

## 2.8 PLYWOOD BACKING PANELS

- A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exterior, AC in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

## 2.9 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
  - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
  - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

## 2.10 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Flexible Flashing: Self-adhesive, rubberized-asphalt compound, bonded to a high-density, polyethylene film to produce an overall thickness of not less than 0.025 inch.
- C. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
- D. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.
- E. Semi Transparent Staining of the glue Laminated Timbers and Sawn Roof Deck, to be Done by Manufacturer. Color to match Architect's selection.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- D. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.
- E. Do not splice structural members between supports, unless otherwise indicated.
- F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
  - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
  - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
  - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
  - 3. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
- H. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- I. Comply with AWP A M4 for applying field treatment to cut surfaces of preservative-treated lumber.
  - 1. Use inorganic boron for items that are continuously protected from liquid water.
  - 2. Use copper naphthenate for items not continuously protected from liquid water.

- J. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. NES NER-272 for power-driven fasteners.
  - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
- K. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.
- L. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
  - 1. Comply with approved fastener patterns where applicable.
  - 2. Use finishing nails, unless otherwise indicated. Countersink nail heads and fill holes with wood filler.

### 3.2 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.
- C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- D. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

### 3.3 WALL AND PARTITION FRAMING INSTALLATION

- A. General: Provide single bottom plate and double top plates using members of 2-inch nominal (38-mm actual) thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction unless otherwise indicated.
  - 1. For exterior and interior bearing walls, provide 2-by-6-inch nominal- (38-by-140-mm actual-) size wood studs spaced 16 inches (406 mm) o.c. unless otherwise indicated.
  - 2. For interior non-bearing partitions and walls, provide 2-by-4-inch nominal- (38-by-89-mm actual-) size wood studs spaced 16 inches (406 mm) o.c. unless otherwise indicated.
  - 3. Provide continuous horizontal blocking at midheight of partitions more than 96 inches (2438 mm) high, using members of 2-inch nominal (38-mm actual) thickness and of same width as wall or partitions.
- B. Construct corners and intersections with three or more studs, except that two studs may be used for interior non-load-bearing partitions.

- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
  - 1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal (89-mm actual) depth for openings 48 inches (1200 mm) and less in width, 6-inch nominal (140-mm actual) depth for openings 48 to 72 inches (1200 to 1800 mm) in width, 8-inch nominal (184-mm actual) depth for openings 72 to 120 inches (1800 to 3000 mm) in width, and not less than 10-inch nominal (235-mm actual) depth for openings 10 to 12 feet (3 to 3.6 m) in width.
  - 2. For load-bearing walls, provide double-jamb studs for openings 60 inches (1500 mm) and less in width, and triple-jamb studs for wider openings, see plans and header schedule.

### 3.4 CEILING JOIST AND RAFTER FRAMING INSTALLATION

- A. Ceiling Joists: Install ceiling joists with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.
  - 1. Where ceiling joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate and nail to first joist or anchor with framing anchors or metal straps. Provide 1-by-8-inch nominal- (19-by-184-mm actual-) size or 2-by-4-inch nominal- (38-by-89-mm actual-) size stringers spaced 48 inches (1200 mm) o.c. crosswise over main ceiling joists.
- B. Rafters: Notch to fit exterior wall plates and use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.
  - 1. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches (50 mm) deeper. Bevel ends of jack rafters for full bearing against valley rafters.
  - 2. At hips, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches (50 mm) deeper. Bevel ends of jack rafters for full bearing against hip rafter.
- C. Provide collar beams (ties) as indicated or, if not indicated, provide 1-by-4-inch nominal- (19-by-140-mm actual-) size boards between every third pair of rafters, but not more than 48 inches (1219 mm) o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.
- D. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions if any.

### 3.5 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

## SECTION 061600 - SHEATHING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Wall sheathing.
  - 2. Roof sheathing.
- B. Related Sections include the following:
  - 1. Section 06 1000 "Rough Carpentry" for plywood backing panels.
  - 2. Section 07 2700 "Air Barriers" for air barrier membrane, and flexible flashings at openings in sheathing.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
  - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
  - 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
  - 3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For following products, from ICC-ES:
  - 1. Preservative-treated plywood.

#### 1.5 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. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- 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. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

### 2.2 WALL SHEATHING

- A. Plywood Wall Sheathing: Exterior sheathing.
  - 1. Span Rating: Not less than 16/0.
  - 2. Nominal Thickness: Not less than 7/16 inch.
- B. Plywood Interior Shear Wall Sheathing:
  - 1. Span Rating: Not less than 16/0.
  - 2. Nominal Thickness: Not less than 7/16 inch.

### 2.3 ROOF SHEATHING

- A. Exterior Plywood Roof Sheathing: Exposure 1, Structural I sheathing.
  - 1. Span Rating: Not less than 24/0.
  - 1. Nominal Thickness: 5/8 inch over roof trusses.

### 2.4 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWWPA U1; Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground].
  - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

- C. Application: Treat items indicated on Drawings.

## 2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
  - 1. For wall and roof sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
  - 2. Fasten roof sheathing to wood decking with 8d x 1½" nails or #10 x 1½" screws, see plan for spacing.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
  - 1. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
- D. Coordinate wall sheathing installation with flashing and joint-treatment installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

### 3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:

1. Wall and Roof Sheathing:
  - a. Nail to wood framing.
  - b. Space panels 1/8 inch apart at edges and ends.
2. Subflooring:
  - a. Glue and nail to wood framing.
  - b. Space panels 1/8 inch apart at edges and ends.

END OF SECTION 061600

## SECTION 061753 - SHOP-FABRICATED WOOD TRUSSES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Wood roof trusses.
  - 2. Wood floor trusses.
  - 3. Wood truss bracing.
  - 4. Metal truss accessories.
- B. Related Sections include the following:
  - 1. Section 061600 "Sheathing" for roof sheathing.

#### 1.3 DEFINITIONS

- A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.
- B. TPI: Truss Plate Institute, Inc.
- C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
  - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
  - 2. NLGA: National Lumber Grades Authority.
  - 3. SPIB: The Southern Pine Inspection Bureau.
  - 4. WCLIB: West Coast Lumber Inspection Bureau.
  - 5. WWPA: Western Wood Products Association.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For fire-retardant-treated lumber, metal-plate connectors, metal truss accessories, and fasteners.
  - 1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
  - 2. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.

3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- B. Product Data: For metal-plate connectors, metal truss accessories, and fasteners.
- C. Shop Drawings: Prepared by or under the supervision of a qualified professional engineer. Show fabrication and installation details for trusses.
  1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
  2. Indicate sizes, stress grades, and species of lumber.
  3. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
  4. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
  5. Show splice details and bearing details.
  6. 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.
- D. Delegated-Design Submittal: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss fabricating firm.
- B. Evaluation Reports: For the following, from ICC-ES:
  1. Metal-plate connectors.
  2. Metal truss accessories.

#### 1.6 QUALITY ASSURANCE

- A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.
  1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
- B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that complies with quality-control procedures in TPI 1 and that involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.
- C. Source Limitations for Connector Plates: Obtain metal connector plates from a single manufacturer.
- D. Comply with applicable requirements and recommendations of the following publications:
  1. TPI 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."

2. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
  3. TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."
- E. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store trusses to comply with recommendations of TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."
1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
  2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
  3. Provide for air circulation around stacks and under coverings.
- B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

#### 1.8 COORDINATION

- A. Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying progress of other trades whose work must follow erection of trusses.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Division 01 Section "Quality Requirements," to design metal-plate-connected wood trusses.
- B. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.
1. Design Loads: As indicated.
  2. Maximum Deflection Under Design Loads:
    - a. Roof Trusses: Vertical deflection of 1/240 of span.
    - b. Floor Trusses: Vertical deflection of 1/360 of span.

#### 2.2 DIMENSION LUMBER

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
  2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
  3. Provide dressed lumber, S4S.
  4. Provide dry lumber with 19 percent maximum moisture content at time of dressing.
- B. Grade and Species: For truss chord and web members, provide dimension lumber of any species, graded visually or mechanically, and capable of supporting required loads without exceeding allowable design values according to AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."
- C. Minimum Chord Size for Roof Trusses: 2 by 4 inches nominal for both top and bottom chords unless required otherwise by design.
- D. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 061000 Rough Carpentry.

## 2.3 METAL CONNECTOR PLATES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Alpine Engineered Products, Inc.
  2. Cherokee Metal Products, Inc.; Masengill Machinery Company.
  3. CompuTrus, Inc.
  4. Eagle Metal Products.
  5. Jager Building Systems, Inc.
  6. MiTek Industries, Inc.; a subsidiary of Berkshire Hathaway Inc.
  7. Robbins Engineering, Inc.
  8. TEE-LOK Corporation; a subsidiary of Berkshire Hathaway Inc.
  9. Truswal Systems Corporation.
- B. General: Fabricate connector plates to comply with TPI 1.
- C. Hot-Dip Galvanized Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 coating designation; and not less than 0.036 inch thick.

## 2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.

- F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
  - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

## 2.5 METAL TRUSS ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cleveland Steel Specialty Co.
  - 2. Harlen Metal Products, Inc.
  - 3. KC Metals Products, Inc.
  - 4. Simpson Strong-Tie Co., Inc.
  - 5. Southeastern Metals Manufacturing Co., Inc.
  - 6. USP Structural Connectors.
- B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- C. Hot-Dip Heavy-Galvanized-Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.
- D. Truss Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening roof trusses to wall studs below, 2-1/2 inches wide by 0.062 inch thick. Tie fits over top of truss and fastens to both sides of truss, inside face of top plates, and both sides of stud below.
- E. Roof Truss Clips: Angle clips for bracing bottom chord of roof trusses at non-load-bearing walls, 1-1/4 inches wide by 0.050 inch thick. Clip is fastened to truss through slotted holes to allow for truss deflection.
- F. Floor Truss Hangers: U-shaped hangers, full depth of floor truss, with 1-3/4-inch- (44-mm-) long seat; formed from metal strap 0.062 inch (1.6 mm) thick with tabs bent to extend over and be fastened to supporting member.

## 2.6 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 94 percent zinc dust by weight.

## 2.7 FABRICATION

- A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.
- B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.
- C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
  - 1. Fabricate wood trusses within manufacturing tolerances in TPI 1.
- D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install wood trusses only after supporting construction is in place and is braced and secured.
- B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.
- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Install and brace trusses according to TPI recommendations and as indicated.
- E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.
- F. Space trusses as indicated; adjust and align trusses in location before permanently fastening.
- G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in truss accessories according to manufacturer's fastening schedules and written instructions.
- H. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
  - 1. Install bracing to comply with Section 061000 Rough Carpentry.
  - 2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.
- I. Install wood trusses within installation tolerances in TPI 1.
- J. Do not cut or remove truss members.
- K. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.

- L. Replace wood trusses that are damaged or do not meet requirements.
  - 1. Damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by Architect.

### 3.2 REPAIRS AND PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- C. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- D. Protective Coating: Clean and prepare exposed surfaces of metal connector plates. Brush apply primer, when part of coating system, and one coat of protective coating.
  - 1. Apply materials to provide minimum dry film thickness recommended by coating system manufacturer.

END OF SECTION 061753

**SECTION 06 4100**  
**ARCHITECTURAL WOOD CASEWORK**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Specially fabricated cabinet units.
- B. Hardware.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 12 3600 - Countertops.

**1.03 REFERENCE STANDARDS**

- A. ANSI A208.1 - American National Standard for Particleboard; 2022.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- D. BHMA A156.9 - Cabinet Hardware; 2020.
- E. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
  - 1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
- C. Product Data: Provide data for hardware accessories.
- D. Selection Samples: Provide physical samples of HPL manufacturer's standard colors and patterns. Allow for HPL with custom printed colors and patterns at circulation desks.
- E. Verification Samples: Allow for providing physical samples measuring 12 x 12 inches minimum for HPL selections that include patterns.

**1.06 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
  - 1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.

**1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Protect units from moisture damage.

**1.08 FIELD CONDITIONS**

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

**PART 2 PRODUCTS**

**2.01 CABINETS**

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Plastic Laminate Faced Cabinets: Custom grade.

C. Cabinets:

1. Finish - Exposed Exterior Surfaces: Decorative laminate.
2. Finish - Exposed Interior Surfaces: Decorative laminate.
3. Finish - Semi-Exposed Surfaces: Decorative laminate
4. Finish - Concealed Surfaces: Manufacturer's option.
5. Door and Drawer Front Edge Profiles: Square edge with thick applied band.
6. Door and Drawer Front Retention Profiles: Fixed panel.
7. Casework Construction Type: Type A - Frameless.
8. Interface Style for Cabinet and Door: Style 1 - Overlay; flush overlay.
9. Adjustable Shelf Loading: 40 psf.
10. Cabinet Style: Flush overlay.
11. Cabinet Doors and Drawer Fronts: Flush style.
12. Drawer Side Construction: Multiple-dovetailed.
13. Drawer Construction Technique: Dovetail joints.

## **2.02 WOOD-BASED COMPONENTS**

- A. Wood fabricated from old growth timber is not permitted.

## **2.03 PANEL CORE MATERIALS**

- A. Particleboard: Composite panel composed of cellulosic particles, additives, and bonding system; comply with ANSI A208.1.
1. Grade: M-2; moisture resistance: MR10.
  2. Panel Thickness: 3/4 inch.

## **2.04 LAMINATE MATERIALS**

- A. Manufacturers:
1. Formica Corporation: [www.formica.com/#sle](http://www.formica.com/#sle).
  2. Panolam Industries International, Inc: [www.panolam.com/#sle](http://www.panolam.com/#sle).
  3. Wilsonart LLC: [www.wilsonart.com/#sle](http://www.wilsonart.com/#sle).
  4. Substitutions: See Section 01 6000 - Product Requirements.
- B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications. Allow for HPL with custom printed colors and patterns at circulation desks.
- C. Provide specific types as follows:
1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, through color, color as selected, finish as selected.
  2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, through color, color as selected, finish as selected.
  3. Cabinet Liner: CLS, 0.020 inch nominal thickness, through color, color as selected, finish as indicated.
  4. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

## **2.05 COUNTERTOPS**

- A. Countertops: See Section 12 3600.

## **2.06 ACCESSORIES**

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Plastic Edge Banding: Extruded PVC, flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
1. Color: As selected by Architect from manufacturer's full range.
- C. Fasteners: Size and type to suit application.
- D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

- E. Concealed Joint Fasteners: Threaded steel.
- F. Grommets: Standard plastic grommets for cut-outs, in color to blend with adjacent surface.

## **2.07 HARDWARE**

- A. Cabinet Hardware: Comply with BHMA A156.9 for hardware types and grades indicated below:
  - 1. Hardware Types: Drawer slides.
  - 2. Product Grade: Grade 2.
- B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.
- C. Vanity Brackets: Fixed, ADA-compliant, face-of-stud mounting.
  - 1. Material and Shape: Steel; formed compound shapes.
    - a. Finish: Manufacturer's standard, factory-applied, textured powder coat.
- D. Drawer and Door Pulls: "U" shaped wire pull, steel with chrome finish, 4 inch centers.
- E. Keyed Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.
- F. Cabinet Catches and Latches:
  - 1. Type: Roller catch.
- G. Drawer Slides:
  - 1. Type: Full extension with overtravel.
  - 2. Static Load Capacity: Heavy Duty grade.
  - 3. Mounting: Side mounted.
  - 4. Stops: Integral type.
  - 5. Features: Provide self closing/stay closed type.
- H. Hinges: European style concealed self-closing type, steel with nickel-plated finish.

## **2.08 FABRICATION**

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
  - 1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
- E. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inches on center.
- F. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Seal cut edges.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

### **3.02 INSTALLATION**

- A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

- B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- C. Use fixture attachments in concealed locations for wall mounted components.
- D. Use concealed joint fasteners to align and secure adjoining cabinet units.
- E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- F. Secure cabinets to floor using appropriate angles and anchorages.

### **3.03 ADJUSTING**

- A. Adjust moving or operating parts to function smoothly and correctly.

### **3.04 CLEANING**

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

**END OF SECTION 06 4100**

**SECTION 07 0553  
FIRE AND SMOKE ASSEMBLY IDENTIFICATION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Identification markings for fire and smoke rated partitions, and fire rated walls.

**1.02 RELATED REQUIREMENTS**

- A. Section 09 9123 - Interior Painting: Paint finish.

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of marking stencil, indicating font, colors, wording, and overall dimensions.

**1.04 FIELD CONDITIONS**

- A. Do not install painted markings when ambient temperature is lower than recommended by coating manufacturer.

**PART 2 PRODUCTS**

**2.01 FIRE AND SMOKE ASSEMBLY IDENTIFICATION**

- A. Regulatory Requirements: Meet or exceed requirements of 2018 NC Building Code paragraph 703.7 "Marking and Identification", and as noted below:
  - 1. Above ceilings, mark both sides of each rated wall within 15 feet of each end of each wall, and horizontally along each wall at intervals not exceeding 30 feet.
  - 2. Provide lettering not less than 3 inches high with a minimum 3/8 inch stroke width, painted in a contrasting color.
  - 3. Wording of markings to describe type of rating indicated on drawings. For example: "2 HOUR FIRE BARRIER - PROTECT ALL OPENINGS."
- B. Painted Fire and Smoke Assembly Identification: Identification markings applied to partition with paint and a code compliant stencil meeting font height and stroke width noted above.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that substrate surfaces are ready to receive work.

**3.02 PREPARATION**

- A. See Section 09 9123 for substrate preparation for painted markings.

**3.03 INSTALLATION**

- A. Locate markings as required by section 2.01 above.
- B. Paint markings with wall paint system specified in Section 09 9123, in contrasting color. Attic stock is not required for marking paint.
- C. Install neatly, with horizontal edges level.
- D. Protect from damage until Date of Substantial Completion; repair or replace damaged markings.

**END OF SECTION 07 0553**

## **SECTION 07 1300 SHEET WATERPROOFING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Self-adhered HDPE sheet membrane, post applied.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete substrate.
- B. Section 06 1600 - Sheathing: Wood panel substrate.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
- B. NRCA (WM) - The NRCA Waterproofing Manual; 2021.

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for membrane and surface conditioner.
- C. Manufacturer's Installation Instructions: Indicate special procedures.

#### **1.05 MOCK-UPS**

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Install waterproofing on mockup specified in Section 04 2000 - Unit Masonry. Coordinate with work of other sections in construction of mockup.
- C. Locate where directed.

### **PART 2 PRODUCTS**

#### **2.01 SHEET WATERPROOFING MATERIALS**

- A. Self-Adhered HDPE Sheet Membrane, Post-Applied: Recommended by manufacturer for placement on outside face of below grade concrete and concrete masonry unit (CMU) backfilled walls and select horizontal applications.
  - 1. Sheet Thickness: 60 mil, 0.060 inch, minimum.
  - 2. Water Vapor Permeance: Less than 0.1 perm, measured in accordance with ASTM E96/E96M.
  - 3. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.
  - 4. Products:
    - a. GCP Applied Technologies; Preprufe 800PA: [www.gcpat.com/#sle](http://www.gcpat.com/#sle).
    - b. EPRO Services, Inc; PrimeTak: [www.eproinc.com/#sle](http://www.eproinc.com/#sle).
    - c. Polyguard Products, Inc; 650 Sheet Membrane: [www.polyguard.com/#sle](http://www.polyguard.com/#sle).
    - d. Tremco Commercial Sealants & Waterproofing; TREMproof 560A: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - e. Substitutions: See Section 01 6000 - Product Requirements.

#### **2.02 ACCESSORIES**

- A. Membrane Sealant: As recommended by membrane manufacturer.
- B. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and waterproofing materials.
- C. Surface Conditioner: Manufacturer's recommended type, compatible with membrane.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions are acceptable prior to starting work.
- B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.
- C. Verify that items penetrating surfaces to receive waterproofing are securely installed.
- D. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.
- E. Do not proceed with work until unsatisfactory conditions have been corrected.

### **3.02 PREPARATION**

- A. Protect adjacent surfaces from damage not designated to receive waterproofing.
- B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.
- C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.
- D. Fill nonmoving joints and cracks with a filler compatible with waterproofing materials.
- E. Surfaces for Adhesive Bonding: Apply surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.

### **3.03 INSTALLATION - MEMBRANE**

- A. Install membrane waterproofing in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
- B. Follow manufacturer's instructions for minimum temperature for membrane installation.
- C. Roll out membrane, and minimize wrinkles and bubbles.
- D. Self-Adhering Membrane: Remove release paper layer, and roll out onto substrate with a mechanical roller to provide full contact bond.
- E. Overlap edges and ends, minimum 3 inches, seal permanently waterproof by method recommended by manufacturer, and apply uniform bead of sealant to joint edge.
- F. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.
- G. Seal membrane and flashings to adjoining surfaces.

### **3.04 PROTECTION**

- A. Do not permit traffic over unprotected or uncovered membrane.
- B. To avoid damage to membrane by construction activities, sun exposure, and weathering, provide temporary protection over membrane immediately after installation and until permanent cover is installed.

**END OF SECTION 07 1300**

**SECTION 07 2100  
THERMAL INSULATION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Thermal batt insulation in exterior wall construction and as indicated on drawings.
- B. Acoustical batt insulation.
- C. Batt insulation for filling perimeter window and door shim spaces.
- D. Insulating foam sealant.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 2700 - Air Barriers: Separate air barrier materials.
- B. Section 07 5400 - Thermoplastic Membrane Roofing: Board insulation over low slope roof deck.

**1.03 REFERENCE STANDARDS**

- A. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- C. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

**1.05 FIELD CONDITIONS**

- A. Store insulation indoors, and avoid exposure to moisture.

**PART 2 PRODUCTS**

**2.01 APPLICATIONS**

- A. Insulation in exterior Wood Framed Walls: Batt insulation with no vapor retarder.
- B. Insulation in interior Wood Framed Walls: Batt insulation with no vapor retarder.
- C. Insulation at window and door shim spaces: Batt insulation with no vapor retarder.
- D. Insulation at building envelope penetrations: Insulating foam sealant.

**2.02 MINERAL FIBER BLANKET INSULATION MATERIALS**

- A. Flexible Glass Fiber Blanket Thermal and Acoustical Insulation: Preformed insulation, complying with ASTM C665; friction fit.
  - 1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
  - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
  - 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
  - 4. Formaldehyde Content: Zero.
  - 5. Thermal Resistance: At exterior walls, minimum R-value of 22.
  - 6. Thickness:
    - a. 2x8 Walls: 8 inch, nominal.
    - b. 2x6 Walls: 5-1/2 inch.
    - c. 2x4 Walls: 3-1/2.

- d. Furred spaces and chases: Provide insulation of thickness to completely fill furred space or chase.
- 7. Facing: Unfaced.
- 8. Products:
  - a. CertainTeed Corporation; InsulPure: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  - b. Johns Manville; Unfaced Fiberglass: [www.jm.com/#sle](http://www.jm.com/#sle).
  - c. Knauf Insulation, Inc.; Performance+ Ecobatt Insulation: [www.knaufnorthamerica.com](http://www.knaufnorthamerica.com).
  - d. Owens Corning Corporation; Pink Next Gen: [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).
  - e. Substitutions: See Section 01 6000 - Product Requirements.

### **2.03 INSULATING FOAM SEALANT MATERIALS**

- A. Insulating Foam Sealant: Minimal-expanding, single-component polyurethane foam sealant for general purpose building envelope air sealing.
  - 1. Products:
    - a. Dupont; Great Stuff Gaps & Cracks Foam: [www.greatstuff.dupont.com](http://www.greatstuff.dupont.com).
    - b. Dewalt; Powerfoam: [www.dewalt.com](http://www.dewalt.com).
    - c. Sika Corporation; Sika Boom: [www.usa.sika.com](http://www.usa.sika.com).
    - d. Substitutions: See Section 01 6000 - Product Requirements.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Do not install batt insulation until building is dried in.
- C. Protect batt insulation from exposure to moisture.

### **3.02 BATT INSTALLATION**

- A. Install insulation in accordance with manufacturer's instructions.
- B. Install in exterior wall spaces and as indicated on drawings without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

### **3.03 INSULATING FOAM SEALANT**

- A. Apply in accordance with manufacturer's instructions.
- B. Insulate and seal penetrations in building envelope.
- C. After insulation has cured, trim flush with face of wall.

### **3.04 PROTECTION**

- A. Do not permit installed insulation to be damaged prior to its concealment.
- B. Do not install insulation that has been exposed to moisture.
- C. Replace any insulation exposed to moisture.

**END OF SECTION 07 2100**

## **SECTION 07 2700 AIR BARRIERS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Air barriers.

#### **1.02 RELATED REQUIREMENTS**

#### **1.03 DEFINITIONS**

- A. Air Barrier: Airtight barrier made of material that is virtually air impermeable but water vapor permeable, both to amount as specified, with sealed seams and sealed joints to adjacent surfaces.

#### **1.04 REFERENCE STANDARDS**

- A. ASTM E2556 - Standard Specification for Vapor Permeable Flexible Sheet Water-Resistive Barriers Intended for Mechanical Attachment
- B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
- E. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

#### **1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on material characteristics, performance criteria, and limitations.
- C. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

#### **1.06 MOCK-UPS**

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Install air barrier sheet and perimeter conditions on mock-up specified in Section 04 2000 - Unit Masonry. Coordinate with work of other sections in construction of mock-up.
- C. Locate where directed.

#### **1.07 FIELD CONDITIONS**

- A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

### **PART 2 PRODUCTS**

#### **2.01 AIR BARRIER MATERIALS (AIR IMPERMEABLE AND WATER VAPOR PERMEABLE)**

- A. Air Barrier Sheet, Mechanically Fastened:
  - 1. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
  - 2. Water Vapor Permeance: 10 perms, minimum, when tested in accordance with ASTM E96/E96M using Procedure A - Desiccant Method, at 73.4 degrees F.
  - 3. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 90 days of weather exposure.
  - 4. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 50 or less, Class A, when tested in accordance with ASTM E84.

5. Seam and Perimeter Tape: Polyethylene self-adhering type, mesh reinforced, 2-1/2 inches wide, compatible with sheet material; or as recommended by manufacturer for project conditions.
6. Products:
  - a. DuPont de Nemours, Inc; Tyvek CommercialWrap: [building.dupont.com/#sle](http://building.dupont.com/#sle).
  - b. Henry Company; WeatherSmart Commercial: [www.henry.com/#sle](http://www.henry.com/#sle).
  - c. National Shelter Products, Inc; DRYLine HPX Commercial: [www.drylinewrap.com/#sle](http://www.drylinewrap.com/#sle).
  - d. TYPAR; TYPAR BuildingWrap: [www.typar.com/#sle](http://www.typar.com/#sle).
  - e. VaproShield, LLC; WrapShield IT - Integrated Tape: [www.vaproshield.com/#sle](http://www.vaproshield.com/#sle).
  - f. Substitutions: See Section 01 6000 - Product Requirements.

## **2.02 ACCESSORIES**

- A. Sealants, Tapes, and Accessories for Sealing Air Barrier and Adjacent Substrates: As indicated or in compliance with air barrier manufacturer's installation instructions.
- B. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement waived if not installed on roof.
  1. Width: As recommended by air barrier manufacturer for project conditions, and as detailed..
- C. Thinners and Cleaners: As recommended by material manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces and conditions are ready for work of this section.
- B. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.
- C. Do not proceed with this work until unsatisfactory conditions have been corrected.

### **3.02 PREPARATION**

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
- B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's installation instructions.

### **3.03 INSTALLATION**

- A. Install materials in accordance with manufacturer's installation instructions.
- B. Air Barriers: Install continuous airtight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.
- D. Mechanically Fastened Sheets - On Exterior:
  1. Install sheets shingle fashion to shed water, with seams generally horizontal.
  2. Overlap seams as recommended by manufacturer, 6 inches, minimum.
  3. Overlap at outside and inside corners as recommended by manufacturer, 12 inches, minimum.
  4. Attach to framed construction with fasteners extending through sheathing into framing, and space fasteners at 6 to 18 inches (152 to 460 mm) on center along each framing member supporting sheathing, as recommended in manufacturer's installation instructions.
  5. Seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners as recommended by manufacturer.
  6. Install air barrier underneath jamb flashings.

- E. Openings and Penetrations in Exterior Air Barriers:
  - 1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto air barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
  - 2. At openings with nonflanged frames, seal air barrier to each side of framing at opening using flashing at least 9 inches wide, and covering entire depth of framing.
  - 3. At head of openings, install flashing under air barrier extending at least 2 inches beyond face of jambs; seal air barrier to flashing.
  - 4. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
  - 5. Service and Other Penetrations: Form flashing around penetrating item and seal to air barrier surface.

#### **3.04 FIELD QUALITY CONTROL**

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Do not cover installed air barriers until required observations have been completed, and work has been accepted by Architect.
- C. Obtain approval of installation procedures from air barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.
- D. Take digital photographs of each portion of installation prior to covering up air barriers.

#### **3.05 PROTECTION**

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

**END OF SECTION 07 2700**

**SECTION 07 4213  
METAL WALL PANELS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Manufactured metal panels for exterior wall panels and soffit panels, with related flashings and accessory components.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Wall panel substrate.
- B. Section 07 2700 - Air Barriers: Air barrier under wall panels.
- C. Section 07 9200 - Joint Sealants: Sealing joints between metal wall panel system and adjacent construction.

**1.03 REFERENCE STANDARDS**

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2023.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:
  - 1. Physical characteristics of components shown on shop drawings.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation instructions and recommendations.
- C. Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips, and methods of anchorage. Show fastener types and spacings to resist positive and negative wind pressures at middle-of-wall and corner zones indicated on structural drawings. Include documentation indicating wall and soffit panel compliance with wind performance requirements.
- D. Color Selection Samples: Pre-finished metal chips or original copy of manufacturer's color card.

**1.05 MOCK-UPS**

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Install metal wall panels on mock-up specified in Section 04 2000 - Unit Masonry. Coordinate with work of other sections in construction of mock-up.
- C. Locate as directed by Architect.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.
- C. Prevent contact with materials that may cause discoloration or staining of products.

**1.07 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Finish Warranty: Provide 15-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Metal Wall Panels - Concealed Fasteners, Color 1:
  - 1. ATAS International, Inc; Rigid Wall II - MFN120, MFN123, and MFN124; even mix of each profile, installed in random pattern: [www.atas.com/#sle](http://www.atas.com/#sle).
  - 2. Dimensional Metals, Inc.; Series HWP - HWPA12, HWPC12, and HWPH12; even mix of each profile, installed in random pattern: [www.dmimetals.com](http://www.dmimetals.com).
  - 3. Elevate; UNA-CLAD Delta Concealed Fastener Panel-12B, 12F, and 12T; even mix of each profile, installed in random pattern: [www.holcimelevate.com/#sle](http://www.holcimelevate.com/#sle).
  - 4. Fabral; Silhoutte HCF Series 12-1, 12-2, and 12-3; even mix of each profile, installed in random pattern: [www.fabral.com/#sle](http://www.fabral.com/#sle).
  - 5. Morin Corporation; Integrity Series X-12, XB-12, and XG-12; even mix of each profile, installed in random pattern: [www.morincorp.com/#sle](http://www.morincorp.com/#sle).
  - 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Metal Wall Panels - Concealed Fasteners, Color 2:
  - 1. ATAS International, Inc; Rigid Wall II MFN122: [www.atas.com/#sle](http://www.atas.com/#sle).
  - 2. Dimensional Metals, Inc.; Series HWP, HWPB12: [www.dmimetals.com](http://www.dmimetals.com).
  - 3. Elevate; UNA-CLAD Delta CFP-12: [www.holcimelevate.com/#sle](http://www.holcimelevate.com/#sle).
  - 4. Fabral; Silhoutte HCF Series 12-1C: [www.fabral.com/#sle](http://www.fabral.com/#sle).
  - 5. Morin Corporation; Integrity Series XC-12: [www.morincorp.com/#sle](http://www.morincorp.com/#sle).
  - 6. Substitutions: See Section 01 6000 - Product Requirements.
- C. Metal Soffit Panels:
  - 1. ATAS International, Inc; Versa-Seam: [www.atas.com/#sle](http://www.atas.com/#sle).
  - 2. Dimensional Metals, Inc.; Flush Panel FP10: [www.dmimetals.com](http://www.dmimetals.com).
  - 3. Elevate; Una-Clad UC-500: [www.holcimelevate.com](http://www.holcimelevate.com).
  - 4. Fabral; Decor-Flush II: [www.fabral.com/#sle](http://www.fabral.com/#sle).
  - 5. Morin Corporation; Primo Soffit PS-12: [www.morincorp.com/#sle](http://www.morincorp.com/#sle).
  - 6. Substitutions: See Section 01 6000 - Product Requirements.

### **2.02 METAL WALL PANEL SYSTEM**

- A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
  - 1. Provide exterior wall panels and soffit panels.
  - 2. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
  - 3. Design Pressure: In accordance with ASCE 7 and as indicated on drawings.
  - 4. Maximum Allowable Deflection of Panel:  $L/180$  for length(L) of span.
  - 5. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
  - 6. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
  - 7. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
- B. Exterior Wall Panels:
  - 1. Profile: Vertical and horizontal, as indicated; style as indicated.
    - a. Color 1: Vertical.
    - b. Color 2: Horizontal.
  - 2. Side Seams: Double-interlocked, tight-fitting, <>.
  - 3. Material: Precoated steel sheet, 24 gauge, 0.239 inch minimum thickness; provide thickness needed to meet wind load requirements.
  - 4. Panel Width: 12 inches.

5. Color: As selected by Architect from manufacturer's standard line, allow for two colors. See drawings for locations and extents of each color.
- C. Soffit Panels:
  1. Profile: Style as indicated, with venting not provided.
  2. Material: Precoated steel sheet, 24 gauge, 0.239 inch minimum thickness, and as needed to meet wind load requirements.
  3. Color: As selected by Architect from manufacturer's standard line.
  4. Panel Width: 12 inches.
- D. Expansion Joints: Same material, thickness and finish as exterior sheets; of profile as detailed on drawings.
- E. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles as detailed on drawings.
- F. Wall Panel Attachment Clips: Stainless or galvanized steel.

### **2.03 MATERIALS**

- A. Precoated Steel Sheet: Aluminum-zinc alloy-coated steel sheet, ASTM A792/A792M, Commercial Steel (CS)) or Forming Steel (FS), with AZ50/AZM150 coating; continuous-coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

### **2.04 FINISHES**

- A. Exposed Surface Finish: Panel manufacturer's 70% polyvinylidene fluoride (PVDF) superior performing organic coatings system, colors as selected by Architect from manufacturer's standard line.
- B. Panel Backside Finish: Panel manufacturer's standard coating.

### **2.05 ACCESSORIES**

- A. Concealed Sealants: Non-curing butyl sealant or tape sealant.
- B. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane, color to match finish of metal panels and trim.
- C. Fasteners: Manufacturer's standard type to suit application; stainless steel, weather resistant epoxy-coated steel, or hot dip galvanized steel. Electrogalvanized or mechanically galvanized fasteners are not acceptable.
- D. Field Touch-up Paint: As recommended by panel manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that building framing members are ready to receive panels.
- B. Verify air barrier, see Section 07 2700, has been installed over wall panel substrate.

### **3.02 PREPARATION**

- A. Protect surrounding areas and adjacent surfaces from damage during execution of this work.

### **3.03 INSTALLATION**

- A. Install panels on walls and soffits in accordance with manufacturer's instructions.
- B. Vertical Panels: Install three specified panel profiles in a random pattern.
- C. Protect surfaces in contact with dissimilar metals with bituminous paint; allow to dry prior to wall panel installation.
- D. Fasten panels to structural supports using fastener type and spacing to resist wind loads at project site; aligned, level, and plumb.
- E. Provide expansion and control joints where indicated.

- F. Use concealed fasteners unless otherwise indicated by Architect.

#### **3.04 TOLERANCES**

- A. Offset From True Alignment Between Adjacent Members Abutting or In Line: 1/16 inch, maximum.
- B. Variation from Plane or Location As Indicated on Drawings: 1/4 inch, maximum.

#### **3.05 CLEANING**

- A. Remove site cuttings from finish surfaces.
- B. Remove protective material from wall panel surfaces.

#### **3.06 PROTECTION**

- A. Protect metal wall panels until completion of project.
- B. Touch-up, repair, or replace damaged wall panels or accessories before Date of Substantial Completion.

**END OF SECTION 07 4213**

**SECTION 07 5400  
THERMOPLASTIC MEMBRANE ROOFING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Adhered system with thermoplastic roofing membrane.
- B. Insulation, flat and tapered.
- C. Cover boards.
- D. Flashings.
- E. Roofing stack boots and walkway pads.

**1.02 RELATED REQUIREMENTS**

**1.03 REFERENCE STANDARDS**

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.
- C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023a.
- D. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin-Based Sheet Roofing; 2021.
- E. NRCA (RM) - The NRCA Roofing Manual; 2025.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene one week before starting work of this section.
  - 1. Review preparation and installation procedures and coordinating and scheduling required with related work.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for each type of product, including but not limited to: membrane materials, flashing materials, insulation, fasteners, and adhesives.
- C. Shop Drawings: Submit drawings that indicate plans, elevations, sections, details, and attachments to other work.
  - 1. Base flashings and membrane terminations. Indicate details meet requirements of NRCA required by this section.
  - 2. Roof plan showing types and orientation of roof cover board and orientation of membrane roofing. Include a roofing insulation setting plan. Show fastener spacings and patterns for mechanically fastened components, and adhesive patterns for adhered components, to resist wind uplift pressures in field-of-roof, perimeter, and corners.
  - 3. Wind Uplift Resistance Submittal: Provide manufacturer's test reports documenting that submitted roofing system meets or exceeds wind uplift performance requirements indicated on structural drawings. Include documentation of roofing system materials, fastener types and spacing, adhesive types and application rates, and other considerations required to meet performance requirements.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
  - 1. Submit evidence of compliance with performance requirements.
  - 2. Indicate manufacturer has verified compatibility of roofing system components, including but not limited to: Roofing membrane, cover board, fasteners, flashing sheets, adhesives, and sealants.

- E. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions given.
- F. Installer's qualification statement.
- G. Specimen Warranty: For approval.
- H. Warranty Documentation:
  - 1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
  - 2. Submit installer's written verification that installation complies with warranty conditions for waterproof membrane.
- I. Inspection Reports: Roofing Inspector's report to include weather conditions, description of work performed, tests performed, defective work observed, and coorrective actions taken to correct defective work. Submit reports within 48 hours after inspection.

#### **1.06 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing work of this section with at least five years of documented experience and approved by manufacturer.
- B. Manufacturer Installation Instructions: Obtain and maintain on-site access to manufacturer's written recommendations and instructions for installation of products.
- C. Roofing Inspector Qualifications:
  - 1. Roofing Inspector shall be one of the following:
    - a. Authorized full-time technical employee of roofing manufacturer not engaged in the sale of products.
    - b. Independent party certified as a Registered Roof Observer by the International Institute of Building Enclosure Consultants (Formerly the Roof Consultants Institute) retained by the Contractor of the manufacturer, and approved by the manufacturer.
  - 2. Experienced in installation and maintenance of specified roofing system, qualified to perform roofing observation and inspection specified in Field Quality Control, to determine installer's compliance with Project requirements, and approved by manufacturer to issue warranty certification.

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

- A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact, unless otherwise indicated. Packaging to indicate manufacturer, product brand name and type, date of manufacture, approval of listing agency markings, and directions for storing and mixing with other components.
- B. Store materials in weather protected environment, clear of ground and moisture.
- C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking and structure.
- D. Protect foam insulation from direct exposure to sunlight, moisture, soiling, etc. Comply with insulation manufacturer's written instructions for handling, storing, and protection during installation.
- E. Store liquids in original undamaged containers in clean, dry, protected location within temperature range required by roofing system manufacturer, and protect from exposure to direct sunlight.
  - 1. Remove from proje and legally dispose of materials that cannot be applied within stated shelf life.

#### **1.08 FIELD CONDITIONS**

- A. 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. Do not apply insulation or roofing during unsuitable weather.

- B. Daily Protection: Coordinate installation of roofing so insulation and other components of roofing system not permanently exposed and are not subjected to precipitation or left uncovered at end of workday or when precipitation is forecast.
  - 1. Provide tie-offs at end of each day's work, to cover exposed roofing and insulation with a course of roofing sheet securely in place with joints and edges sealed.
  - 2. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing.
  - 3. Remove temporary plugs from roof drains at end of each day.
  - 4. Remove and discard temporary seals before beginning work on adjoining roof.
- C. Do not apply roofing membrane when ambient temperature is outside of manufacturer's recommended range.
- D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

## **1.09 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Workmanship Warranty: The Contractor shall warrant the materials and workmanship of the roofing system against leakage and defects due to faulty materials, workmanship, and contractor negligence for a period of two (2) years following acceptance of the project by the Owner.
- C. Material Warranty: Provide membrane manufacturer's warranty agreeing to replace material that shows manufacturing defects within five years after installation.
- D. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.
  - 1. Warranty Term: 20 years.
  - 2. For repair and replacement include costs of both material and labor in warranty.
  - 3. Exceptions are not Permitted:
    - a. Damage due to wind speeds up to and including 120 miles per hour.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Thermoplastic Polyolefin (TPO) Membrane Roofing Materials:
  - 1. Carlisle SynTec Systems; FleeceBACK TPO Adhered 60 mil: [www.carlisle-syntec.com/#sle](http://www.carlisle-syntec.com/#sle).
  - 2. GAF; EverGuard Fleece Back TPO 60 mil: [www.gaf.com/#sle](http://www.gaf.com/#sle).
  - 3. Johns Manville; JM TPO FB - 115 mil: [www.jm.com/#sle](http://www.jm.com/#sle).
  - 4. Versico Roofing Systems; VersiFleece TPO 115 mil: [www.versico.com/#sle](http://www.versico.com/#sle).
  - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Insulation:
  - 1. Carlisle SynTec Systems; SecurShield Insulation: [www.carlisle-syntec.com/#sle](http://www.carlisle-syntec.com/#sle).
  - 2. GAF; EnergyGuard Ultra Polyiso Insulation: [www.gaf.com/#sle](http://www.gaf.com/#sle).
  - 3. Johns Manville; ENRGY 3 CGF - Flat and Tapered: [www.jm.com/#sle](http://www.jm.com/#sle).
  - 4. Versico Roofing Systems; SecurShield Insulation: [www.versico.com/#sle](http://www.versico.com/#sle).
  - 5. Substitutions: See Section 01 6000 - Product Requirements.
- C. Cover Boards:
  - 1. Georgia-Pacific; DensDeck Prime with EONIC Technology: [www.densdeck.com/#sle](http://www.densdeck.com/#sle).
  - 2. Gold Bond Building Products, LLC provided by National Gypsum Company; DEXcell FA Glass Mat Roof Board: [www.goldbondbuilding.com/#sle](http://www.goldbondbuilding.com/#sle).
  - 3. USG Corporation; Securock: [www.usg.com](http://www.usg.com).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

## **2.02 ROOFING**

- A. Thermoplastic Membrane Roofing: One ply membrane, fully adhered, over insulation and cover board.
- B. Roofing Assembly Requirements:
  - 1. Wind Uplift Resistance: Install roofing system using materials and installation methods tested by the manufacturer to resist wind uplift pressures indicated on structural drawings for field-of-roof, perimeter, and corners.
  - 2. Insulation Thermal Resistance (R-Value): 4-1/2 per inch, minimum; provide one layer of 2-1/2 inch and one layer of 2 inch, offset joints between layers.
- C. Acceptable Insulation Types - Constant Thickness Application:
  - 1. Minimum 2 layers of polyisocyanurate board.
- D. Acceptable Insulation Types - Tapered Application:
  - 1. Uniform thickness polyisocyanurate board covered with tapered polyisocyanurate board.

## **2.03 MEMBRANE ROOFING AND ASSOCIATED MATERIALS**

- A. Membrane Roofing Materials:
  - 1. TPO: Thermoplastic polyolefin (TPO) complying with ASTM D6878/D6878M, sheet contains reinforcing fabrics or scrims, with fleece backing.
    - a. Membrane Thickness: 60 mil, 0.060 inch, minimum.
  - 2. Sheet Width: Factory fabricated into widest possible sheets.
    - a. Adhered Application: Limit width to 120 inches, maximum, when ambient temperatures are less than 40 degrees F for extended period of time during installation.
  - 3. Color: White.
- B. Seaming Materials: As recommended by membrane manufacturer.
- C. Flexible Flashing Material: Same material as membrane.
- D. TPO-Clad Metal Flashing Material: Minimum 24 gauge sheet steel, minimum A50 zinc-aluminum coating with 70% PVDF finish, clad with factory-applied roofing membrane material. Architect to select color from manufacturer's standard range of colors.

## **2.04 COVER BOARDS**

- A. Cover Boards: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.
  - 1. Thickness: 5/8 inch, Type X, fire-resistant.
  - 2. Board Size: 48 by 96 inches.

## **2.05 INSULATION**

- A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
  - 1. Classifications:
    - a. Type II: Faced with either cellulosic facers or glass fiber mat facers on both major surfaces of the core foam.
      - 1) Class 2 - Faced with coated glass fiber mat facers on both major surfaces of the core foam.
      - 2) Compressive Strength: Classes 1-2-3, Grade 2, 20 psi (138 kPa), minimum.
      - 3) Thermal Resistance, R-value: At 1-1/2 inches thick; Class 1, Grades 1-2-3, 8.4 (1.48), minimum, at 75 degrees F.
  - 2. Board Size: 48 by 96 inches.
  - 3. Tapered Board: Slope as indicated; minimum thickness 1/2 inch; fabricate of fewest layers possible.
  - 4. Board Edges: Square.

## **2.06 ACCESSORIES**

- A. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.

- B. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
  - 1. Length as required for thickness of insulation material and penetration of deck substrate, with metal washers. At areas where underside of roof deck is exposed to interior of building, provide fastener lengths to avoid penetrating through underside of roof deck.
- C. Membrane Adhesive: As recommended by membrane manufacturer.
- D. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.
- E. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.
- F. Insulation Adhesive: As recommended by insulation manufacturer.
- G. Roofing Nails: Galvanized, hot-dipped type, size and configuration as required to suit application.
- H. Sealants: As recommended by membrane manufacturer.
- I. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
  - 1. Composition: Roofing membrane manufacturer's standard.
  - 2. Surface Color: White or Yellow.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that surfaces and site conditions are ready to receive work.
- B. Verify deck is supported and secure.
- C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice.
- E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and nailing strips are in place.

#### **3.02 PREPARATION - WOOD DECK**

- A. Verify flatness and tightness of joints in wood decking; fill knot holes with latex filler.
- B. Confirm dry deck by moisture meter with 12 percent moisture maximum.

#### **3.03 INSTALLATION, GENERAL**

- A. Perform work in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.
- B. Do not apply roofing membrane during cold or wet weather conditions.
- C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.
- D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- F. Coordinate this work with installation of associated counterflashings installed by other sections as the work of this section proceeds.

#### **3.04 INSTALLATION - INSULATION, UNDER MEMBRANE**

- A. Attachment of Insulation: Install roofing insulation per roofing manufacturer's instructions.
- B. Cover Boards: Mechanically fasten cover boards in accordance with roofing manufacturer's instructions.

- C. Lay subsequent layers of insulation with joints staggered minimum 6 inches from joints of preceding layer.
- D. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.
- E. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
- F. At roof drains, use factory-tapered boards to slope down to roof drains over a distance of 18 inches.
- G. Do not install more insulation than can be covered with membrane in same day.

### **3.05 INSTALLATION - MEMBRANE**

- A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.
- B. Shingle joints on sloped substrate in direction of drainage.
- C. Fully Adhered Application: Apply adhesive to substrate at roofing manufacturer's recommended rate. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.
- D. Overlap edges and ends by the amount recommended by the roofing manufacturer and seal seams by roofing manufacturer's recommended method. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.
- E. At intersections with vertical surfaces:
  - 1. Extend membrane up a minimum of 8 inches onto vertical surfaces.
  - 2. Fully adhere flexible flashing over membrane and up to nailing strips.
  - 3. Secure flashing to nailing strips as recommended by roofing manufacturer.
- F. Around roof penetrations, seal flanges and flashings with flexible flashing.
- G. Coordinate installation of roof drains and sumps and related flashings.

### **3.06 FIELD QUALITY CONTROL**

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Provide <> on-site attendance of roofing manufacturer's representative during installation of this work.

### **3.07 CLEANING**

- A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.
- B. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.
- C. Repair or replace defaced or damaged finishes caused by work of this section.

### **3.08 PROTECTION**

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

**END OF SECTION 07 5400**

## **SECTION 07 7100 ROOF SPECIALTIES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Manufactured roof specialties, including fascias.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 07 7200 - Roof Accessories: Manufactured curbs, roof hatches, and snow guards.

#### **1.03 REFERENCE STANDARDS**

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2022.
- C. NRCA (RM) - The NRCA Roofing Manual; 2025.

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.
- C. Color Selection Samples: Pre-finished metal chips or original copy of manufacturer's color card.
- D. Manufacturer's Installation Instructions: Indicate special procedures, fasteners, supporting members, and perimeter conditions requiring special attention.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Roof Edge Flashings and Copings:
  - 1. ATAS International, Inc; Rapid-Lok Fascia: [www.atas.com/#sle](http://www.atas.com/#sle).
  - 2. Hickman Edge Systems; TerminEdge Fascia: [www.hickmanedgesystems.com/#sle](http://www.hickmanedgesystems.com/#sle).
  - 3. Metal-Era Inc; Anchor-Tite Standard Fascia: [www.metalera.com/#sle](http://www.metalera.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

#### **2.02 COMPONENTS**

- A. Roof Edge Flashings: Factory fabricated to sizes required; corners mitered; concealed fasteners.
  - 1. Configuration: Fascia, and edge securement for roof membrane.
  - 2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-2 to negative design wind pressure as defined by applicable local building code for project location and as indicated on drawings.
  - 3. Exposed Face Height: As indicated on drawings.
  - 4. Material: Formed steel sheet, galvanized, 24 gauge, 0.024 inch thick, minimum.
  - 5. Finish: 70 percent polyvinylidene fluoride (PVDF).
  - 6. Color: As selected by Architect from manufacturer's standard range. Allow for two colors.

#### **2.03 FINISHES**

- A. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; color as selected from manufacturer's standard colors.

#### **2.04 ACCESSORIES**

- A. Sealant for Joints in Linear Components: As recommended by component manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.
  - 1. See Section 07 7200 for information on roofing related accessories.

### **3.02 INSTALLATION**

- A. Install components in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.
- B. Seal joints within components when required by component manufacturer.
- C. Anchor components securely.
- D. Coordinate installation of components of this section with installation of roofing membrane and base flashings.
- E. Coordinate installation of sealants and roofing cement with work of this section to ensure water tightness.

**END OF SECTION 07 7100**

**SECTION 07 7123  
MANUFACTURED GUTTERS AND DOWNSPOUTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Pre-finished galvanized steel gutters and downspouts.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 5400 - Thermoplastic Membrane Roofing.
- B. Section 33 4000 - Site Storm Drainage Utilities: Connection of downspouts to storm sewer.

**1.03 REFERENCE STANDARDS**

- A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- C. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on prefabricated components.
- C. Color Selection Samples: Prefinished metal color chips or original copy of manufacturer's color card showing standard range of colors.

**1.05 DELIVERY, STORAGE, AND HANDLING**

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

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Pre-Finished Galvanized Steel Sheet: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.02 inch thick base metal.
  - 1. Finish: Shop pre-coated with PVDF (polyvinylidene fluoride) coating.
  - 2. Color: As selected by Architect from manufacturer's standard colors.
- B. Protective Backing Paint: Zinc molybdate alkyd.

**2.02 COMPONENTS**

- A. Gutters: SMACNA rectangular style profile.
- B. Downspouts: SMACNA rectangular profile.
- C. Anchors and Supports: Profiled to suit gutters and downspouts.
  - 1. Anchoring Devices: In accordance with SMACNA requirements.
  - 2. Gutter Supports: Brackets.
  - 3. Downspout Supports: Brackets, spaced not more than 6 feet apart, and within 1 foot of bottom end.
- D. Fasteners: Same material and finish as gutters and downspouts.

**2.03 FABRICATION**

- A. Form gutters and downspouts of profiles and sizes indicated.
- B. Fabricate with required connection pieces.

- C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.
- D. Hem exposed edges of metal.
- E. Fabricate gutter and downspout accessories; seal watertight.

#### **2.04 FINISHES**

- A. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604, multiple coat, thermally cured fluoropolymer finish system; color as indicated.
- B. Primer Coat: Finish concealed side of metal sheets with primer compatible with finish system, as recommended by finish system manufacturer.

#### **2.05 ACCESSORIES**

- A. Splash Pads: See drawings and Section 07 5400.
- B. Downspout Boots: See Section 33 4000.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that surfaces are ready to receive work.

#### **3.02 PREPARATION**

- A. Paint concealed sheet metal surfaces and surfaces in contact with dissimilar metals or masonry with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

#### **3.03 INSTALLATION**

- A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.
- B. Sheet Metal: Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts and accessories.
- C. Connect downspouts to downspout boots and Seal connection watertight.

**END OF SECTION 07 7123**

## **SECTION 07 7200 ROOF ACCESSORIES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Roof hatches with safety railings.

#### **1.02 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used.
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
  - 4. Maintenance requirements.
- C. Warranty Documentation:
  - 1. Submit manufacturer warranty.
  - 2. Ensure that forms have been completed in Owner's name and registered with manufacturer.
  - 3. Submit documentation that roof accessories are acceptable to roofing manufacturer, and do not limit the roofing warranty.

#### **1.03 DELIVERY, STORAGE, AND HANDLING**

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

### **PART 2 PRODUCTS**

#### **2.01 ROOF HATCHES AND VENTS**

- A. Roof Hatch Manufacturers:
  - 1. Acudor Products Inc; RHA Ship Stair Access: [www.acudor.com/#sle](http://www.acudor.com/#sle).
  - 2. Babcock-Davis; Personnel BA3054: [www.babcockdavis.com/#sle](http://www.babcockdavis.com/#sle).
  - 3. Bilco Company; NB-50: [www.bilco.com/#sle](http://www.bilco.com/#sle).
  - 4. Dur-Red Products; RHUA-2ST: [www.dur-red.com/#sle](http://www.dur-red.com/#sle).
  - 5. Nystrom, Inc; Personnel A3054: [www.nystrom.com/#sle](http://www.nystrom.com/#sle).
  - 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Roof Hatches: Factory-assembled aluminum frame and cover, complete with operating and release hardware.
- C. Safety Railing System: Roof hatch manufacturer's safety rail system mounted directly to curb without penetration of roofing system.
- D. Hardware: Steel, zinc coated and chromate sealed, unless otherwise indicated or required by manufacturer.
  - 1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf load.
  - 2. Hinges: Manufacturer's standard type.
  - 3. Hold open arm with vinyl-coated handle for manual release.
  - 4. Latch: Upon closing, engage latch automatically and reset manual release.
  - 5. Manual Release: Pull handle on interior.
  - 6. Locking: Padlock hasp on interior.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.

- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### **3.02 PREPARATION**

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

### **3.03 INSTALLATION**

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

### **3.04 PROTECTION**

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

**END OF SECTION 07 7200**

## **SECTION 07 8400 FIRESTOPPING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Firestopping systems.
- B. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 07 0553 - Fire and Smoke Assembly Identification.
- B. Section 09 2116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems; 2020a.
- B. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2020a.
- C. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

#### **1.05 FIELD CONDITIONS**

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. Firestopping Materials: Any materials meeting requirements.
- B. Mold and Mildew Resistance: Provide firestopping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.
- C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- D. Fire Ratings: Refer to drawings for required systems and ratings.

#### **2.02 FIRESTOPPING SYSTEMS**

- A. Firestopping: Any material meeting requirements.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify openings are ready to receive the work of this section.

#### **3.02 PREPARATION**

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.

### **3.03 INSTALLATION**

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- C. Install labeling required by code.

### **3.04 FIELD QUALITY CONTROL**

- A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174 and ASTM E2393.
- B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

### **3.05 CLEANING**

- A. Clean adjacent surfaces of firestopping materials.

### **3.06 PROTECTION**

- A. Protect adjacent surfaces from damage by material installation.

**END OF SECTION 07 8400**

## **SECTION 07 9100 PREFORMED JOINT SEALS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Precompressed foam seals.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 07 9200 - Joint Sealants: Liquid and mastic joint sealants and their backing materials.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM D1056 - Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber; 2020.

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's technical data sheets for each product, including chemical composition, movement capability, limitations on application, and installation instructions.

### **PART 2 PRODUCTS**

#### **2.01 PRECOMPRESSED FOAM SEALS**

- A. Precompressed Foam Seal: Comprised of urethane, modified-acrylic impregnated, open-cell polyurethane, or closed-cell neoprene foam impregnated with water-repellent, and with self-adhesive faces protected prior to installation by release paper.
  - 1. Color: Black.
  - 2. Size as required to provide weathertight seal when installed.
  - 3. Calculate size according to manufacturer's recommendations.
  - 4. Measure size of existing joints before selecting seal width.
  - 5. Applications:
    - a. Primary or secondary seal for wall joints between curtain wall framing and masonry veneer, and as indicated on drawings.
  - 6. Products:
    - a. EMSEAL Joint Systems, Ltd.; 25V: [www.emseal.com](http://www.emseal.com).
    - b. LymTal International, Inc.; Iso-Flex Precomp B: [www.lymtal.com](http://www.lymtal.com).
    - c. Tremco; Willseal 600: [www.tremcosealants.com](http://www.tremcosealants.com).
    - d. Substitutions: See Section 01 6000 - Product Requirements.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that joints are ready to receive this work.
- B. Measure joint dimensions and verify that seal products are of the correct size to properly seal the joints.

#### **3.02 PREPARATION**

- A. Properly prepare construction components adjacent to the work of this section to prevent damage and disfigurement due to this work.

#### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's written instructions.
- B. Precompressed Foam Seals:
  - 1. Install only when ambient temperature is within recommended application temperature range of adhesive. Consult manufacturer when installing outside this temperature range.
  - 2. Prepare joints and install seals in accordance with manufacturer's written recommendations.

3. Remove loose materials and foreign matter that could impair adhesion of sealant.
4. Do not stretch precompressed seal; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch below adjoining surface.

#### **3.04 PROTECTION**

- A. Protect joints from damage until adhesives have properly cured.

**END OF SECTION 07 9100**

## **SECTION 07 9200 JOINT SEALANTS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

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

#### **1.02 RELATED REQUIREMENTS**

- A. Section 07 9100 - Preformed Joint Seals: Precompressed foam, gaskets, and strip seals.
- B. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
- C. Section 09 3000 - Tiling: Sealant junctions with other materials and changes in plane.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).
- B. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).
- E. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.
- F. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2023.
- G. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
  - 1. Physical characteristics, including movement capability, hardness, cure time, and color availability.
  - 2. List of backing materials approved for use with the specific product.
  - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
  - 4. Substrates the product should not be used on.
  - 5. Substrates for which use of primer is required.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- E. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.

#### **1.05 MOCK-UPS**

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Install sealant joints on mock-up specified in Section 04 2000 - Unit Masonry. Coordinate with work of other sections in construction of mock-up.

- C. Locate where directed.

## **PART 2 PRODUCTS**

### **2.01 JOINT SEALANT APPLICATIONS**

- A. Scope:
1. Exterior Joints:
    - a. Seal open joints except open joints indicated on drawings as not sealed.
  2. Interior Joints:
    - a. Seal open joints except specific open joints indicated on drawings as not sealed.
  3. Do Not Seal:
    - a. Intentional weep holes in masonry and curtain wall assemblies.
    - b. Joints where sealant is specified to be furnished and installed by manufacturer of product to be sealed.
    - c. Joints where sealant installation is specified in other sections.
    - d. Joints between suspended ceilings and walls.

### **2.02 JOINT SEALANTS - GENERAL**

### **2.03 NONSAG JOINT SEALANTS**

- A. Nonstaining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
  2. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
  3. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
  4. Color: To be selected by Architect from manufacturer's standard range.
  5. Products:
    - a. Dow; DOWSIL 795 Silicone Building Sealant: [www.dow.com/#sle](http://www.dow.com/#sle).
    - b. Sika Corporation; Sikasil WS-295: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
    - c. Tremco Commercial Sealants & Waterproofing; Spectrem 2: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
- B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
1. Color: Color to be selected by Architect from manufacturer's standard range.
  2. Products:
    - a. Dow; Dowsil 786: [www.dow.com](http://www.dow.com).
    - b. Sika Corporation; Sikasil GP: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
    - c. Tremco Commercial Sealants and Waterproofing; Tremsil 200: [www.tremcosealants.com](http://www.tremcosealants.com).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
- C. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 35 percent, minimum.
  2. Color: To be selected by Architect from manufacturer's standard range.
  3. Products:
    - a. Master Builders Solutions; MasterSeal NP1: [www.master-builders-solutions.com/en-us/#sle](http://www.master-builders-solutions.com/en-us/#sle).
    - b. Sika Corporation; Sikaflex-1a: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
    - c. Tremco Commercial Sealants & Waterproofing; Vulkem 116: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
- D. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, nonsagging; not intended for exterior use.

1. Color: Standard colors matching finished surfaces, Type OP (opaque).
- E. Noncuring Butyl Sealant: Solvent-based, single component, nonsag, nonskinning, nonhardening, nonbleeding; nonvapor permeable; intended for fully concealed applications.

## **2.04 SELF-LEVELING JOINT SEALANTS**

- A. Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
  1. Composition: Multicomponent, 100 percent solids by weight.
  2. Durometer Hardness: Minimum of 85 for Type A or 35 for Type D, after seven days when tested in accordance with ASTM D2240.
  3. Color: Concrete gray.
  4. Joint Width, Minimum: 1/8 inch.
  5. Joint Width, Maximum: 1/4 inch.
  6. Joint Depth: Provide product suitable for joints from 1/8 inch to 2 inches in depth including space for backer rod.

## **2.05 ACCESSORIES**

- A. Sealant Backing Rod, Closed-Cell Type:
  1. Cylindrical flexible sealant backings complying with ASTM C1330 Type C.
  2. Size: 25 to 50 percent larger in diameter than joint width.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

### **3.02 PREPARATION**

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

### **3.03 INSTALLATION**

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

### **3.04 POST-OCCUPANCY**

- A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width, i.e., at low temperature in thermal cycle. Report failures immediately and repair them.

**END OF SECTION 07 9200**

**SECTION 08 1116  
ALUMINUM DOORS AND FRAMES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Aluminum frames.

**1.02 RELATED REQUIREMENTS**

- A. Section 08 1416 - Flush Wood Doors: Wood doors to be installed in aluminum frames specified in this section.
- B. Section 08 4313 - Aluminum-Framed Storefronts: Aluminum entrance doors and sliding mall storefronts.
- C. Section 08 4413 - Glazed Aluminum Curtain Walls.
- D. Section 08 7100 - Door Hardware.
- E. Section 08 8000 - Glazing: Glazing materials for aluminum frames.

**1.03 REFERENCE STANDARDS**

- A. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.
- B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
- C. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- E. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- F. ITS (DIR) - Directory of Listed Products; Current Edition.
- G. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.
- H. UL (DIR) - Online Certifications Directory; Current Edition.
- I. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's descriptive literature for each type of door and frame; include information on fabrication methods, finishing, hardware preparation, accessories, and installation.
- C. Shop Drawings: Include elevations of each opening type, schedule of openings, wall thickness for each frame, glazing thickness, and fire ratings.
  - 1. Verify dimensions by field measurements before fabrication and indicate on shop drawings.
- D. Manufacturer's qualification statement.
- E. Installer's qualification statement.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

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

- A. Deliver aluminum components in manufacturer's standard protective packaging, palletted, crated, or banded together.
- B. Inspect delivered components for damage and replace. Repaired components will not be accepted.
- C. Store components in clean, dry, indoor area, under cover in manufacturer's packaging until installation.
- D. Protect materials and finish from damage during handling and installation.

## **PART 2 PRODUCTS**

### **2.01 BASIS OF DESIGN - ALUMINUM FRAMES**

- A. Fire Rated Aluminum Door Frames:
  - 1. Wilson Partitions; Fire Rated Frame: [www.wilsonpart.com](http://www.wilsonpart.com).
- B. Non-Rated Aluminum Door Frames:
  - 1. Wilson Partitions; Snap-On Trim - Series 200 with 2" Trim For Non-Standard Partition: [www.wilsonpart.com](http://www.wilsonpart.com).
- C. Other Manufacturers: Provide either product identified as "Basis of Design" or an equivalent product of one of the manufacturers below.
  - 1. Avalon International Aluminum LLC: [www.avalonint.com/#sle](http://www.avalonint.com/#sle).
  - 2. Raco Interior Products: [www.racointeriors.com](http://www.racointeriors.com).
  - 3. Substitutions: See Section 01 6000 - Product Requirements.
    - a. For any product not identified as "Basis of Design", submit information as specified for substitutions.

### **2.02 DOOR FRAMES**

- A. Accessibility: Comply with ICC A117.1 and ADA Standards.
- B. Aluminum Frames for Doors, Sidelights, and Transoms: Extruded aluminum, non-thermally broken hollow or C-shaped sections.
  - 1. Frame Depth: To fit wall thicknesses as indicated on drawings.
  - 2. Frames for Fire-Rated Doors Specified Elsewhere: Tested in accordance with NFPA 252, listed and labeled by UL (DIR), ITS (DIR), or testing agency acceptable to authorities having jurisdiction.
  - 3. Fire Door Frames: Comply with fire tests for door assemblies in accordance with UL 10C requirements.
    - a. Fire Rating: As indicated on drawings.
  - 4. Weatherstripping: Replaceable pile type; at jambs and head.
  - 5. Sidelight/Transom Glazing: See Section 08 8000.
- C. Dimensions and Shapes: As indicated on drawings; dimensions indicated are nominal.
  - 1. Provide vision lites as indicated on drawings.
  - 2. Provide the following clearances:
    - a. Hinge and Lock Stiles: 1/8 inch.
    - b. At Top Rail and Bottom Rail: 1/8 inch.

### **2.03 COMPONENTS**

- A. Frames: Extruded aluminum shapes, reinforced at hinge and strike locations.
  - 1. Trim: Extruded aluminum, removable snap-in type without exposed fasteners.
- B. Vision Lites: Extruded aluminum framed, gasket glazed.
  - 1. Glazing: See Section 08 8000.
- C. Additional Door Hardware: See Section 08 7100.
- D. Replacable Weatherstripping: Manufacturer's standard for door frame types specified.

## **2.04 FINISHES**

- A. Class II Natural Anodized Finish: Clear anodic coating; AAMA 611 AA-M12C22A31, minimum dry film thickness (DFT) of 0.4 mil, 0.0004 inch minimum.

## **2.05 ACCESSORIES**

- A. Fasteners: Aluminum, non-magnetic stainless steel, or other material warranted by manufacturer as non-corrosive and compatible with aluminum components.
- B. Brackets and Reinforcements: Manufacturer's high-strength aluminum units where feasible, otherwise, non-magnetic stainless steel or steel hot-dip galvanized in compliance with ASTM A123/A123M.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that wall surfaces and openings are ready to receive frames and are within tolerances specified in manufacturer's instructions.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### **3.02 PREPARATION**

- A. Perform cutting, fitting, forming, drilling, and grinding of frames as required for project conditions.
- B. Replace components with damage to exposed finishes.
- C. Separate dissimilar metals to prevent electrolytic action between metals.

### **3.03 INSTALLATION**

- A. Install doors and frames in accordance with manufacturer's instructions and approved shop drawings.
- B. Set frames plumb, square, level, and aligned to receive doors. Anchor frames to adjacent construction in strict accordance with manufacturer's recommendations and within specified tolerances.
- C. Hang doors and adjust hardware to achieve specified clearances and proper door operation.
- D. Install door hardware. See Section 08 7100.
- E. Comply with glazing installation requirements. See Section 08 8000.

### **3.04 CLEANING**

- A. Upon completion of installation, thoroughly clean door and frame surfaces in accordance with AAMA 609 & 610.
- B. Do not use abrasive, caustic, or acid cleaning agents.

### **3.05 PROTECTION**

- A. Protect products of this section from damage caused by subsequent construction until Date of Substantial Completion.
- B. Replace damaged or defective components that cannot be repaired to a condition indistinguishable from undamaged components.

**END OF SECTION 08 1116**

**SECTION 08 1416  
FLUSH WOOD DOORS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Flush wood doors; flush, flush glazed, and louvered configurations; fire-rated and non-rated.

**1.02 RELATED REQUIREMENTS**

- A. Section 08 1116 - Aluminum Doors and Frames.
- B. Section 08 7100 - Door Hardware.
- C. Section 08 8000 - Glazing.

**1.03 REFERENCE STANDARDS**

- A. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.
- B. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- C. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2021, with Errata (2022).

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics. Provide product data for louvers.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and louvers, and other details.
- D. Selection Samples: Submit one set of samples of door veneer, illustrating wood grain, stain color, and sheen; include manufacturer's standard range of colors. Submit one set of samples or original printed color sheet for manufacturer's standard range of louver colors.
- E. Specimen warranty.
- F. Warranty, executed in Owner's name.

**1.05 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

**1.06 DELIVERY, STORAGE, AND HANDLING**

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

**1.07 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide manufacturer's warranty on interior doors for the life of the installation. Complete forms in Owner's name and register with manufacturer.
  - 1. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Wood Veneer Faced Doors:

1. Forte Opening Solutions; Aspiro Select Wood Veneer Doors: [www.forteopenings.com](http://www.forteopenings.com).
2. Oshkosh Door Company; Architectural Flush Wood Doors: [www.oshkoshdoor.com](http://www.oshkoshdoor.com).
3. VT Industries, Inc; Heritage Collection: [www.vtindustries.com/#sle](http://www.vtindustries.com/#sle).
4. Substitutions: See Section 01 6000 - Product Requirements.

## **2.02 DOORS**

- A. Doors: See drawings for locations and additional requirements.
  1. Quality Standard: Custom Grade, Extra Heavy Duty performance, in accordance with WDMA I.S. 1A.
  2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
  1. Provide solid core doors at each location.
  2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.

## **2.03 DOOR AND PANEL CORES**

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

## **2.04 DOOR FACINGS**

- A. Veneer Facing for Transparent Finish: Red oak, veneer grade in accordance with quality standard indicated, rift cut (only red and white oak), with slip match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
  1. Vertical Edges: Same species as face veneer.
  2. "Pair Match" each pair of doors.

## **2.05 DOOR CONSTRUCTION**

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
  1. Provide solid blocks at lock edge for hardware reinforcement.
  2. Provide solid blocking for other throughbolted hardware.
- C. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
- D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- F. Provide edge clearances in accordance with the quality standard specified.

## **2.06 FINISHES - WOOD VENEER DOORS**

- A. Finish work in accordance with WDMA I.S. 1A for grade specified and as follows:
  1. Transparent:
    - a. System - TR-8, UV Cured Acrylated Polyester/Urethane.
    - b. Stain: As selected by Architect.
    - c. Sheen: Manufacturer's standard flat or satin.
- B. Factory finish doors in accordance with approved sample.

## **2.07 ACCESSORIES**

- A. Metal Louvers:

1. Material and Finish: Roll formed steel; pre-painted finish to color as selected by Architect from manufacturer's standard range.
  2. Louver Blade: Inverted V blade, sight proof.
  3. Louver Free Area: 50 percent.
- B. Glazing: See Section 08 8000.
- C. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.
- D. Door Hardware: See Section 08 7100.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

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

### **3.02 INSTALLATION**

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
1. Install fire-rated doors in accordance with NFPA 80 requirements.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. Coordinate installation of glazing.
- F. Install door louvers plumb and level.

### **3.03 TOLERANCES**

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

### **3.04 ADJUSTING**

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

**END OF SECTION 08 1416**

**SECTION 08 3100  
ACCESS DOORS AND PANELS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Wall- and ceiling-mounted access units.

**1.02 RELATED REQUIREMENTS**

- A. Section 09 9123 - Interior Painting: Field paint finish.
- B. Divisions 21, 22, 23, 26, and 27: Additional information regarding access panel sizes and locations.

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Manufacturer's Installation Instructions: Indicate installation requirements and rough-in dimensions.

**PART 2 PRODUCTS**

**2.01 ACCESS DOORS AND PANELS ASSEMBLIES**

- A. Wall-Mounted or Ceiling-Mounted Units:
  - 1. Location: As indicated on drawings and at locations noted in the specifications.
  - 2. Size: Minimum of 24 by 24 inches, or as required to service concealed valves, equipment, etc.
  - 3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
  - 4. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.

**2.02 WALL- AND CEILING-MOUNTED ACCESS UNITS**

- A. Manufacturers:
  - 1. Activar Construction Products Group, Inc. - JL Industries: [www.activarcpg.com/#sle](http://www.activarcpg.com/#sle).
    - a. Multipurpose Access Panel: Activar/JL Industries TM.
  - 2. Babcock-Davis; BNT Architectural Access Door: [www.babcockdavis.com/#sle](http://www.babcockdavis.com/#sle).
  - 3. Cendrex, Inc: [www.cendrex.com/#sle](http://www.cendrex.com/#sle).
    - a. Wall-Mounted Units: Cendrex AHD-100 - Flush Universal Access Door with Exposed Flange.
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Wall- and Ceiling-Mounted Units: Factory-fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
  - 1. Material: Steel, hot-dipped zinc or zinc-aluminum-alloy coated.
  - 2. Door Style: Single thickness with rolled or turned in edges.
  - 3. Frames: 16-gauge, 0.0598-inch minimum thickness.
  - 4. Single Steel Sheet Door Panels: 16-gauge, 0.0625-inch minimum thickness.
  - 5. Steel Finish: Primed.
  - 6. Primed and Factory Finish: Polyester powder coat; color as selected by Architect from manufacturer's standard colors.
  - 7. Hardware:
    - a. Hinges for Non-Fire-Rated Units: Continuous piano hinge.
    - b. Latch/Lock: Tamperproof tool-operated cam latch.
    - c. Number of Locks/Latches Required: As recommended by manufacturer for size of unit.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that rough openings are correctly sized and located.
- B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly prior to proceeding with this work.
- B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

### **3.03 INSTALLATION**

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.
- D. Prime and field paint, unless noted otherwise.

**END OF SECTION 08 3100**

**SECTION 08 4229  
AUTOMATIC ENTRANCES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Sliding type packaged power-operated door assemblies.
- B. Controllers, actuators and safety devices.

**1.02 RELATED REQUIREMENTS**

- A. Division 28: Connection to access control system; access control devices used as actuators.

**1.03 DEFINITIONS**

**1.04 REFERENCE STANDARDS**

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
- B. BHMA A156.10 - Power Operated Pedestrian Doors; 2024.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings:
  - 1. Indicate layout and dimensions; head, jamb, and sill conditions; elevations; components, anchorage, recesses, materials, and finishes, electrical characteristics and connection requirements, including use of access control devices as actuators.
  - 2. Indicate anchor type and spacing as recommended by the manufacturer to meet wind loads at the project site.
  - 3. Identify installation tolerances required, assembly conditions, routing of service lines and conduit, and locations of operating components and boxes.
- C. Product Data: Include system components, hardware, sizes, features, and finishes.
- D. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.
- E. Maintenance Data: Include manufacturer's parts list and maintenance instructions for each type of hardware and operating component.
- F. Executed warranty.
- G. Specimen warranty.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements for additional provisions.
  - 2. Wrenches and other tools required for maintenance of equipment.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Sliding Automatic Entrance Door Assemblies:
  - 1. ASSA ABLOY Entrance Solutions; SL 500 Hurricane Resistant Sliding Door Resilience R104: [www.assaabloyentrance.com/#sle](http://www.assaabloyentrance.com/#sle).
  - 2. DORMA USA, Inc; ESA200-HP Hurricane: [www.dorma.com/#sle](http://www.dorma.com/#sle).
  - 3. Stanley Access Technologies; Dura-Storm 2000: [www.stanleyaccess.com/#sle](http://www.stanleyaccess.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

## **2.02 POWER OPERATED DOORS**

- A. Power Operated Doors: Provide products that comply with NFPA 101 and requirements of authorities having jurisdiction; provide equipment selected for actual door weight and for light pedestrian traffic, unless otherwise indicated.
  - 1. Sliding Door Operators: In the event of power failure, provide for manual open, close, and break-away operation of door leaves.
  - 2. Packaged Door Assemblies: Provide components by single manufacturer, factory-assembled, including doors, frames, operators, actuators, and safeties.
    - a. Finish exposed equipment components to match door and frame finish.
  - 3. Wind Load Resistance: Assembly tested and installed to meet loads at project site per ASCE 7 and as indicated on structural drawings.
  - 4. Exterior and Vestibule Doors: Provide equipment suitable for operating temperature range of minus 20 to plus 140 degrees F ambient.
  - 5. Thresholds: Aluminum, type as recommended by manufacturer for project conditions. Provide ramped lead-up at exterior side of exterior door only.
- B. Sliding Doors with Full Power Operators: Comply with BHMA A156.10; safeties required; provide break-away operation unless otherwise indicated; in the event of break-away operation, interrupt power operation.

## **2.03 AUTOMATIC ENTRANCE DOOR ASSEMBLIES**

- A. Comply with applicable local building codes for egress requirements.
- B. Framing Members: Provide manufacturer's standard extruded aluminum framing, reinforced as required to support imposed loads.
  - 1. Nominal Sizes:
    - a. Bi-Parting Sliding Doors: 1-3/4 inch wide by 4-1/2 inch deep.
  - 2. Concealed Fastening: Provide concealed fastening pocket in framing, with continuous flush insert cover extending full length of each framing member.
- C. Door and Sidelight Construction: Heavy duty interlocked extruded aluminum tubular stile and rail sections, through-rod bolted construction with steel corner support at hinge stile of carrier-suspended swinging panels or mechanically fastened corners with welded reinforcing brackets to reduce sag in sliding or breakout mode.
  - 1. Door Thickness: 1-3/4 inch, nominal.
  - 2. Stile Design:
    - a. Medium stile, 3-1/2 inch, nominal width.
  - 3. Top Rail Height: 4 inch, nominal.
  - 4. Bottom Rail Height: 10 inch, nominal.
  - 5. Glazing Stops: Manufacturer's standard snap-on extruded aluminum square stops with preformed resilient glazing gaskets.
  - 6. Glazing Stop Width: Manufacturers standard.
  - 7. Glazing Thickness: 1/4 inch.
- D. Sliding Automatic Door: Bi-parting double leaf track-mounted, electric operation, extruded aluminum glazed door, with frame, and operator concealed overhead.
  - 1. Operation: Power open, power close operation.
  - 2. Exterior-Side Actuator/Safety: Motion sensor.
  - 3. Interior-Side Actuator/Safety: Motion sensor.
  - 4. Hold Open: Toggle switch at inside head of doors; this is not a fire-rated door.
  - 5. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

## **2.04 CONTROLLERS, ACTUATORS, AND SAFETIES**

- A. Controller: Provide microprocessor operated controller for each door.
- B. Comply with BHMA A156.10 for actuator and safety types and zones.

## **2.05 ELECTRICAL CHARACTERISTICS AND COMPONENTS**

- A. Electrical Characteristics:
  - 1. See Division 26 for electrical connections.
- B. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
- C. Disconnect Switch: Factory mount disconnect switch in control panel.
- D. Coordination: Coordinate connection to access control system; access control devices used as actuators.

## **2.06 ACCESSORIES**

- A. Steel Clips, Supports, and Steel Anchors: Galvanized to 1.25 oz/sq ft.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces and openings and recesses are ready to receive work and dimensions are as indicated on shop drawings.
- B. Verify that electric power is available, at the correct location, and is of the correct characteristics.

### **3.02 INSTALLATION**

- A. Install equipment in accordance with manufacturer's written instructions, except where more stringent requirements are specified.
- B. Install entrances securely anchored in place, plumb, level, and true to location, in alignment with established lines and grades, without warp, bow, or racking of members.
- C. Where frames are assembled in field, fit frame joints hairline tight without burrs or distortion; rigidly secure nonmoving joints and seal watertight.
- D. Provide for thermal expansion and contraction of door and frame units and live and dead loads that may be transmitted to operating equipment.
- E. Coordinate installation of components with related and adjacent work; level and plumb.

### **3.03 ADJUSTING**

- A. Adjust entrances for correct function and smooth operation, without binding or scraping and without excessive noise; lubricate operating hardware and other moving parts.

### **3.04 CLEANING**

- A. Remove temporary protection; clean exposed surfaces.

### **3.05 CLOSEOUT ACTIVITIES**

- A. Demonstrate operation, operating components, adjustment features, and lubrication requirements.

**END OF SECTION 08 4229**

**SECTION 08 4313  
ALUMINUM-FRAMED STOREFRONTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Aluminum-framed sliding mall storefront, with vision glass.
- B. Flush aluminum entrance doors.
- C. Thermal glazed aluminum entrance doors.
- D. Weatherstripping.

**1.02 RELATED REQUIREMENTS**

- A. Section 08 1116 - Aluminum Doors and Frames: Interior storefront frames.
- B. Section 08 4413 - Glazed Aluminum Curtain Walls: Door frames.
- C. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.
- D. Section 08 8000 - Glazing: Glass and glazing accessories.

**1.03 REFERENCE STANDARDS**

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.
- B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
- C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate with installation of other components that comprise the exterior enclosure.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
- D. Specimen warranty.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

**1.07 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Aluminum-Framed Storefronts:
  - 1. Arcadia, Inc: [www.arcadiainc.com/#sle](http://www.arcadiainc.com/#sle).
  - 2. Kawneer North America: [www.kawneer.com/#sle](http://www.kawneer.com/#sle).
  - 3. Oldcastle BuildingEnvelope: [www.oldcastlebe.com/#sle](http://www.oldcastlebe.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

### **2.02 BASIS OF DESIGN -- SWINGING DOORS**

- A. Flush, Aluminum-Skinned, Non-Thermal:
  - 1. Basis of Design: Kawneer North America; Flushline Entrances: [www.kawneer.com](http://www.kawneer.com).
- B. Wide Stile, Insulating Glazing, Thermally-Broken:
  - 1. Basis of Design: Kawneer North America; 500T Insulpour: [www.kanweer.com](http://www.kanweer.com).

### **2.03 BASIS OF DESIGN -- SLIDING MALL STOREFRONT**

- A. Interior Sliding Storefront:
  - 1. Basis of Design: Kawneer North America; 1010 Sliding Mall Storefront: [www.kawneer.com](http://www.kawneer.com).

### **2.04 COMPONENTS**

- A. Swinging Doors:
  - 1. Wind Load Resistance: Assembly tested and installed to meet loads at project site per ASCE 7 and as indicated on structural drawings.
  - 2. Flush aluminum.
    - a. Aluminum Skinned, glazed and unglazed as indicated on door schedule:
      - 1) Face Sheets: Embossed aluminum, 0.090 inch thick.
      - 2) Glazing Stops, where applicable: Square.
  - 3. Glazed Aluminum.
    - a. Wide Stile:
      - 1) Top Rail and Vertical Stiles: Manufacturer's standard width for wide stile doors.
      - 2) Bottom Rail: 10 inches wide.
      - 3) Glazing Stops: Square.
- B. Interior Sliding Storefront Doors: Full glazed extruded aluminum frame and operable panels; manual operation; bottom rollers; flat or recessed sill.
  - 1. Configuration and Size: As indicated on drawings.
  - 2. Stile and Face Frame Widths: Manufacturer's standard.
  - 3. Glazing Thickness: 1/4 inch.
  - 4. Sill tracks: Recessed type, as shown on drawings.
  - 5. Provide deadlock keyed both sides on each operable panel.
- C. Glazing: See Section 08 8000.

### **2.05 MATERIALS**

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Fasteners: Stainless steel.
- C. Sealant for Setting Thresholds: Non-curing butyl type.
- D. Glazing Accessories: See Section 08 8000.

### **2.06 FINISHES**

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

### **2.07 HARDWARE**

- A. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

### **3.02 INSTALLATION**

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- I. Install hardware using templates provided.
- J. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

### **3.03 TOLERANCES**

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

### **3.04 ADJUSTING**

- A. Adjust operating hardware and sash for smooth operation.

### **3.05 CLEANING**

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

### **3.06 PROTECTION**

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

**END OF SECTION 08 4313**

**SECTION 08 4413**  
**GLAZED ALUMINUM CURTAIN WALLS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Aluminum-framed curtain wall, with vision glazing.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.
- B. Section 08 4313 - Aluminum-Framed Storefronts: Entrance doors.
- C. Section 08 7100 - Door Hardware.
- D. Section 08 8000 - Glazing.

**1.03 REFERENCE STANDARDS**

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.
- B. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems; 2014.
- C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
- D. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- G. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- H. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.
- I. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).
- J. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015 (Reapproved 2023).

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate with installation of other components that comprise the exterior enclosure.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, and glazing methods.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, conditions requiring steel reinforcing, affected related Work, expansion and contraction joint location and details, and field welding required.
- D. Design Data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations; include load calculations at points of attachment to building structure.

- E. Test Reports: Submit results of manufacturer's testing. Reports of tests previously performed on the same design are acceptable.
- F. Field Quality Control Submittals: Report of field testing for water penetration.
- G. Installer's Qualification Statement.
- H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

#### **1.06 QUALITY ASSURANCE**

- A. Designer Qualifications: Design curtain wall and its structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the State in which the Project is located.
- B. Water Penetration Testing: Have a specimen installed in the building and representative of project conditions tested by Owner's independent testing agency for compliance with specified water penetration criteria.
- C. Installer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.

#### **1.07 MOCK-UPS**

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Install window in opening of mock-up specified in Section 04 2000 - Unit Masonry. Coordinate with work of other sections in construction of mock-up.
- C. Locate where directed.

#### **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

#### **1.09 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Finish Warranty: Provide 5-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

### **PART 2 PRODUCTS**

#### **2.01 BASIS OF DESIGN - CURTAIN WALL SYSTEMS**

- A. Aluminum Pressure Cap at Four Sides; Stick Fabricated for Field Glazing and Thermally Enhanced:
  - 1. Basis of Design: Kawneer North America; 1600 UT Series 1: [www.kawneer.com](http://www.kawneer.com).
- B. Other Manufacturers: Provide either product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below.
  - 1. Apogee Architectural Metals - EFCO or Tubelite: [www.apogeearchmetals.com](http://www.apogeearchmetals.com).
  - 2. Arcadia, Inc: [www.arcadiainc.com/#sle](http://www.arcadiainc.com/#sle).
  - 3. Oldcastle Building Envelope: [www.obe.com](http://www.obe.com).
  - 4. YKK AP America, Inc: [www.ykkap.com/commercial/#sle](http://www.ykkap.com/commercial/#sle).
- C. Substitutions: See Section 01 6000 - Product Requirements.
  - 1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

#### **2.02 CURTAIN WALL**

- A. Aluminum-Framed Curtain Wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.

1. Fabrication Method: Field fabricated stick system.
  2. Glazing Method: Field glazed system with pressure plate and mullion cover.
  3. Provide flush joints and corners, weathersealed, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.
  4. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
  5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
  6. Maintain continuous air barrier and/or vapor retarder seal throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.
  7. Perimeter Clearance: Provide space between framing members and adjacent construction required to allow expected movement, and as indicated on drawings.
- B. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.
1. Design Wind Loads: Comply with the requirements of ASCE 7 and as indicated on structural drawings.
  2. Movement: Accommodate the following movement without damage to components or deterioration of seals:
    - a. Expansion and contraction caused by 180 degrees F surface temperature.
    - b. Expansion and contraction caused by cycling temperature range of 170 degrees F over a 12 hour period.
    - c. Movement of curtain wall relative to perimeter framing.
    - d. Deflection of structural support framing, under permanent and dynamic loads.
- C. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on indoor face when tested as follows:
1. Test Pressure Differential: 15 psf.
  2. Test Method: ASTM E331.
- D. Air Leakage: 0.06 cfm/sq ft maximum leakage of wall area when tested in accordance with ASTM E283/E283M at 6.24 psf pressure difference across assembly.

### **2.03 COMPONENTS**

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
1. Cross-Section, 1 Inch Glazing: 2-1/2 by 7-1/2 inch nominal dimension.
  2. Cross-Section, 1-5/16 Inch Glazing: 2-1/2 by 7-3/4 inch nominal dimension.
  3. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member, where required to resist wind loads.
- B. Pressure Plates: Aluminum.
- C. Glazing: See Section 08 8000.
- D. Filler: At open back mullions, provide manufacturer's snap-in filler.

### **2.04 MATERIALS**

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Structural Steel Sections: ASTM A36/A36M; shop primed.
- C. Fasteners: Stainless steel; type as required or recommended by curtain wall manufacturer.
- D. Exposed Flashings: Aluminum sheet, 18-gauge, 0.040-inch minimum thickness; finish to match framing members.
- E. Concealed Flashings: Sheet aluminum, 20-gauge, 0.032-inch minimum thickness.

- F. Sealant: See Section 07 9200.
- G. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- H. Glazing Accessories: See Section 08 8000.

## **2.05 FINISHES**

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

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

### **3.02 INSTALLATION**

- A. Install curtain wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Install sill flashings set in a minimum of two beads of butyl sealant.
- F. Pack fiberglass insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- G. Pressure Plate Framing: Install glazing using glazing method required to achieve performance criteria; see Section 08 8000.
- H. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

### **3.03 TOLERANCES**

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet noncumulative or 0.5 inches per 100 feet, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.
- C. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 3/4 inch and minimum of 1/4 inch.

### **3.04 FIELD QUALITY CONTROL**

- A. Provide services of curtain wall manufacturer's field representative to observe for proper installation of system and submit report.
- B. See Section 01 4000 - Quality Requirements for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.
- C. Provide field testing of installed curtain wall system by Owner's independent laboratory in accordance with AAMA 503 during construction process and before installation of interior finishes.
  - 1. Perform a minimum of two tests in each designated area as directed by Architect.
  - 2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.
  - 3. Field test for water penetration in accordance with ASTM E1105 with cyclic static air pressure difference (Procedure B) not less than 6.24 psf, for three cycles.

- a. Maximum allowable rate of water penetration in 15-minute test is 0.5 ounce that is not contained in an area with provisions to drain to exterior, or collected on surface of interior horizontal framing member.
- D. Repair or replace curtain wall components that have failed designated field testing, and retest to verify performance complies with specified requirements.

### **3.05 CLEANING**

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, take care to remove dirt from corners, and wipe surfaces clean.

### **3.06 PROTECTION**

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

**END OF SECTION 08 4413**

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
  - 1. Swinging doors.
  - 2. Sliding doors.
  - 3. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
  - 1. Mechanical door hardware.
  - 2. Electromechanical door hardware.
  - 3. Automatic operators.
  - 4. Cylinders specified for doors in other sections.
- C. Related Sections:
  - 1. Division 01 Section "Sustainable Design Requirements" for additional LEED documentation and requirements.
  - 2. Division 01 Section "Closeout Procedures"
  - 3. Division 06 Section "Rough Carpentry".
  - 4. Division 06 Section "Finish Carpentry".
  - 5. Division 08 Section "Operations and Maintenance".
  - 6. Division 08 Section "Door Schedule".
  - 7. Division 08 Section "Hollow Metal Doors and Frames".
  - 8. Division 08 Section "Flush Wood Doors".
  - 9. Division 08 Section "Automatic Entrances".
  - 10. Division 28 Section "Access Control Hardware Devices".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
  - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
  - 2. NFPA 70 - National Electrical Code.
  - 3. NFPA 80 - Fire Doors and Windows.

4. NFPA 101 - Life Safety Code.
  5. NFPA 105 - Installation of Smoke Door Assemblies.
  6. UL/ULC and CSA C22.2 - Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
  7. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
1. ANSI/BHMA Certified Product Standards - A156 Series.
  2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
  3. CAN/ULC-S104 - Standard Method for Fire Tests of Door Assemblies.
  4. ANSI/UL 294 - Access Control System Units.
  5. ULC-S319 - Electronic Access Control Systems.
  6. ULC-60839-11-1, Alarm and Electronic Security Systems - Part 11-1: Electronic Access Control Systems - System and Components Requirements.
  7. UL 305 - Panic Hardware.
  8. ULC-S132, Emergency Exit and Emergency Fire Exit Hardware.
  9. ULC-S533 - Egress Door Securing and Releasing Devices.
  10. ANSI/UL 437- Key Locks.

### 1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
  2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
  3. Content: Include the following information:
    - a. Type, style, function, size, label, hand, and finish of each door hardware item.
    - b. Manufacturer of each item.
    - c. Fastenings and other pertinent information.
    - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.

- e. Explanation of abbreviations, symbols, and codes contained in schedule.
    - f. Mounting locations for door hardware.
    - g. Door and frame sizes and materials.
    - h. Warranty information for each product.
  - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
- 1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
    - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
    - b. Complete (risers, point-to-point) access control system block wiring diagrams.
    - c. Wiring instructions for each electronic component scheduled herein.
  - 2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.
  - 1. Maintenance manual must be provided for tornado/hurricane storm shelter impact protective systems.
- B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

1.5 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
  - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
  - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.
- G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
  - 1. Function of building, purpose of each area and degree of security required.
  - 2. Plans for existing and future key system expansion.
  - 3. Requirements for key control storage and software.
  - 4. Installation of permanent keys, cylinder cores and software.
  - 5. Address and requirements for delivery of keys.
- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s),

Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
  2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
  3. Review sequence of operation narratives for each unique access controlled opening.
  4. Review and finalize construction schedule and verify availability of materials.
  5. Review the required inspecting, testing, commissioning, and demonstration procedures
- I. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

#### 1.7 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.8 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
  - 1. Structural failures including excessive deflection, cracking, or breakage.
  - 2. Faulty operation of the hardware.
  - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 4. Electrical component defects and failures within the systems operation.
- C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

1.9 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
  - 1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.
  - 1. Permanent cylinders, cores, and keys to be installed by Owner.

- D. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

## 2.2 BUTT HINGES

- A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:
  - a. Two Hinges: For doors with heights up to 60 inches.
  - b. Three Hinges: For doors with heights 61 to 90 inches.
  - c. Four Hinges: For doors with heights 91 to 120 inches.
  - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
  - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
  - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
  - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
  - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
4. Hinge Options: Comply with the following:
  - a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.
5. Manufacturers:
  - a. Hager Companies (HA) - BB Series, 5-knuckle.
  - b. Ives (IV) - 5BB Series, 5-knuckle.
  - c. McKinney (MK) - TA/T4A Series, 5-knuckle.

## 2.3 CONTINUOUS HINGES

- A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
  - 1. Where specified, provide modular continuous geared hinges that ship in two or three pieces and form a single continuous hinge upon installation.
  - 2. Manufacturers:
    - a. Hager Companies (HA).
    - b. Ives (IV).
    - c. Pemko (PE).
    - d. Select Hinges (SL).

## 2.4 POWER TRANSFER DEVICES

- A. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.
  - 1. Provide one each of the following tools as part of the base bid contract:
    - a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
    - b. McKinney (MK) - Connector Hand Tool: QC-R003.
  - 2. Manufacturers:
    - a. McKinney (MK) - QC-C Series.
    - b. Schlage (SC) - Connect.
    - c. dormakaba BEST (ST) - WH Series.
    - d. Von Duprin (VD) - Connect.
- B. Provide mortar guard enclosure on steel frames installed at masonry openings for each electrical hinge specified.

## 2.5 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
  2. Furnish dust proof strikes for bottom bolts.
  3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
  4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
  5. Manufacturers:
    - a. Ives (IV).
    - b. Rockwood (RO).
    - c. Trimco (TC).
- B. Coordinators: ANSI/BHMA A156.3 door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.
1. Manufacturers:
    - a. Ives (IV).
    - b. Rockwood (RO).
    - c. Trimco (TC).
- C. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
  2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
  3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
  4. Pulls, where applicable, shall be provided with a 10" clearance from the finished floor on the push side to accommodate wheelchair accessibility.
  5. Leather: Where specified English bridle and Italian Upholstery shall be 10 ounce with hand sewn saddle stitches and hand sewn end line stitches.
  6. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets. When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
  7. Manufacturers:
    - a. Ives (IV).
    - b. Rockwood (RO).
    - c. Trimco (TC).

## 2.6 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy. Manufacturer shall be based in the United States of America.
  - 1. Manufacturers:
    - a. dormakaba BEST (BE).
    - b. Sargent Manufacturing (SA).
    - c. Schlage (SC).
- B. Provide full size interchangeable cylinders/cores to match Owner's keying system, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated.
- C. Keying System: Each type of lock and cylinders to be factory keyed.
  - 1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
  - 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
  - 3. Existing System: Field verify and key cylinders to match Owner's existing system.
  - 4. New System: Key locks to a new key system as directed by the Owner.
- D. Key Quantity: Provide the following minimum number of keys:
  - 1. Change Keys per Cylinder: Two (2) Three (3).
  - 2. Master Keys (per Master Key Level/Group): Five (5).
  - 3. Construction Keys (where required): Ten (10).
  - 4. Construction Control Keys (where required): Two (2).
  - 5. Permanent Control Keys (where required): Two (2).
- E. 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
- F. Key Registration List (Bitting List):
  - 1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
  - 2. Provide transcript list in writing or electronic file as directed by the Owner.
  - 3. Furnish a list of opening numbers with locking devices, showing cylinder types and quantities required when cylinders or cores are to be owner furnished.

## 2.7 KEY CONTROL

- A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.
  - 1. Manufacturers:
    - a. Lund Equipment (LU).
    - b. MMF Industries (MM).
    - c. Telkee (TK).
- B. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational and Security Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.
  - 1. Provide locksets with functions and features as follows:
    - a. Heavy duty 12-gauge wrought steel case.
    - b. Stainless steel 3/4" one-piece anti-friction reversible latchbolt with a one-piece hardened stainless steel 1" projection deadbolt.
    - c. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
    - d. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
    - e. Status indicators inside, outside, or on both sides of doors as specified; available with wording for "locked/unlocked", "vacant/occupied" or custom wording options. Indicator to be located above the cylinder with the inside thumb-turn not blocking the visibility of the indicator status.
    - f. Ten-year limited warranty for mechanical functions.
  - 2. Manufacturers:
    - a. Corbin Russwin Hardware (RU) - ML2000 Series.
    - b. Sargent Manufacturing (SA) - 8200 Series.
    - c. Schlage (SC) - L9000 Series.

## 2.8 FIRE DEPARTMENT LOCK BOX

- A. Fire Department Lock Box: Heavy-Duty, recessed, solid stainless-steel box with hinged door and interior gasket seal; single drill resistant lock with dust covers. Holds 10 keys. Finish as selected by Architect from manufacturer's full range of finishes.
  - 1. Manufacturers:
    - a. Knox Company; Knox-Box Rapid Entry System; KnoxBox 3200: [www.knoxbox.com](http://www.knoxbox.com).

- b. Substitutions: See Section 01 6000 – Product Requirements.

## 2.9 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
  - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
  - 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
  - 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
  - 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards: Comply with the following:
  - 1. Strikes for Mortise Locks and Latches: BHMA A156.13.
  - 2. Strikes for Auxiliary Deadlocks: BHMA A156.36.
  - 3. Dustproof Strikes: BHMA A156.16.

## 2.10 ELECTRIC STRIKES

- A. Standard Electric Strikes: Electric strikes conforming to ANSI/BHMA A156.31, Grade 1, for use on non-rated or fire rated openings. Strikes shall be of stainless steel construction tested to a minimum of 1500 pounds of static strength and 70 foot-pounds of dynamic strength with a minimum endurance of 1 million operating cycles. Provide strikes with 12 or 24 VDC capability, fail-secure unless otherwise specified. Where specified provide latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike.
  - 1. Manufacturers:
    - a. Folger Adam (FO) - 742 Series.
    - b. HES (HS) - 4500 Series.
    - c. Security Door Controls (SD) - 55 Series.
    - d. Von Duprin (VD) - 6200 Series.
- B. Surface Mounted Rim Electric Strikes: Surface mounted rim exit device electric strikes conforming to ANSI/BHMA A156.31, Grade 1, and UL Listed for both Burglary Resistance and for use on fire rated door assemblies. Construction includes internally mounted solenoid with two heavy-duty, stainless steel locking mechanisms operating independently to provide tamper resistance. Strikes tested for a minimum of 500,000 operating cycles. Provide strikes with 12 or 24 VDC capability supplied standard as fail-secure unless otherwise specified. Option available for latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike. Strike requires no cutting to the jamb prior to installation.

1. Manufacturers:
  - a. Folger Adam (FO) - 310-4 Series.
  - b. HES (HS) - 9600/9700 Series.
  - c. Von Duprin (VD) - 6300 Series.

## 2.11 CONVENTIONAL EXIT DEVICES

- A. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide exit devices with functions and features as follows:
  - a. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
  - b. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
  - c. Meets UL Certification Directory ZHLL.R21744 for products used in windstorm rated assemblies.
  - d. Extended cycle test: Exit devices to have been cycle tested in ordinance with ANSI/BHMA 156.3 requirements to 5 million cycles or greater.
  - e. Five-year limited warranty for mechanical features.
2. Electromechanical exit devices shall have the following functions and features:
  - a. Universal Molex plug-in connectors that have standardized color-coded wiring and are field configurable in fail safe or fail secure and operate from 12vdc to 24vdc regulated.
  - b. Options to be available for request-to-exit or enter signaling, latchbolt and touchbar monitoring.
  - c. Field configurable electrified trim to fail-safe or fail-secure that operates from 12-24VDC.
  - d. Five-year limited warranty for electromechanical features.
3. Manufacturers:
  - a. Sargent Manufacturing (SA) - 80 Series.
  - b. dormakaba BEST (PR) - Apex 2000 Series.
  - c. Von Duprin (VD) - 98 Series.

## 2.12 SURFACE DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
  2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
  3. Cycle Testing: Provide closers which have surpassed 15 million cycles.
  4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
  5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
  6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
  7. Closer Covers: Provide PVC free closer covers with a painted finish to match other hardware on the project.
  8. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Commercial Duty): ANSI/BHMA 156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, institutional grade door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard.
1. Manufacturers:
    - a. dormakaba Stanley (ST) - CLD-4551 Series.
    - b. LCN Closers (LC) - 1460 Series.
    - c. Norton Rixson (NO) - 8500 Series.
    - d. Sargent Manufacturing (SA) - 1431 Series.

## 2.13 ARCHITECTURAL TRIM

### A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult

manufacturer's catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:
  - a. Stainless Steel: 300 grade, .050-inch thick.
  - b. Brass or Bronze: .050-inch thick.
  - c. Laminate Plastic or Acrylic: 1/8-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Metal Door Edging: Door protection edging fabricated from a minimum .050-inch thick metal sheet, formed into an angle or "U" cap shapes, surface or mortised mounted onto edge of door. Provide appropriate leg overlap to account for protection plates as required. Height to be as specified in the Hardware Sets.
7. Manufacturers:
  - a. Ives (IV).
  - b. Rockwood (RO).
  - c. Trimco (TC).

#### 2.14 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
  1. Manufacturers:
    - a. Ives (IV).
    - b. Glynn-Johnson (GL)
    - c. Rockwood (RO).
    - d. Trimco (TC).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
  1. Manufacturers:

- a. Norton Rixson (RF).
- b. Rockwood (RO).
- c. Sargent Manufacturing (SA).

## 2.15 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
  - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
  - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Hurricane and Storm Shelter Compliance: Devices to be U.L. listed for windstorm assemblies where applicable. Provide the appropriate hurricane or storm shelter products that have been independently third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.
- G. Manufacturers:
  - 1. National Guard Products (NG).
  - 2. Pemko (PE).
  - 3. Reese Enterprises, Inc. (RE).
  - 4. Zero (ZE).

## 2.16 ELECTRONIC ACCESSORIES

- A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.
  - 1. Manufacturers:
    - a. Sargent Manufacturing (SA) - 3280 Series.
    - b. Security Door Controls (SD) - DPS Series.
    - c. Securitron (SU) - DPS Series.
- B. Intelligent Switching Power Supplies: Provide power supplies with single, dual or multi-voltage configurations at 12 and/or 24VDC. Power Supply shall have battery backup function with an integrated battery charging circuit. The power supply shall have a standard, integrated Fire Alarm Interface (FAI). The power supply shall provide capability for secondary voltage, power distribution, direct lock control and network monitoring through add on modules. The power supply shall be expandable up to 16 individually protected outputs. Output modules shall provide individually protected, continuous outputs and/or individually protected, relay controlled outputs. Network modules shall provide remote monitoring functions such as status reporting, fault reporting and information logging.
  - 1. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
  - 2. Manufacturers:
    - a. Securitron (SU) - AQL Series.
    - b. Altronix (AS) - Maximal 11F.

## 2.17 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

## 2.18 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- D. Typical finishes and materials, unless otherwise specified.
- E. Antimicrobial Finishes: Where specified, finishes on locksets, latchsets, exit devices and push/pull trim to incorporate an FDA recognized. Silver Ion, antimicrobial coating (MicroShield™) listed for use on equipment as a suppressant to the growth and spread of a broad range of bacteria, algae, fungus, mold and mildew.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

#### 3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

#### 3.3 INSTALLATION

- A. Shop Installation: Install hardware on the doors prior to shipment to the jobsite. Field installed hardware will only be permitted as itemized below. Comply with all other Part 3 installation requirements.
  - 1. Extent of shop installed hardware shall include, but is not limited to:
    - a. Hanging devices.
    - b. Latching devices.
    - c. Operating trim.
    - d. Through-door wiring cables.
    - e. Door closers and overhead stops.
    - f. Flush bolts, surface bolts, and coordinating accessories.

- g. Protective trim - protection plates, edge guards, trim protectors.
    - h. Coat hooks, viewers, and all other door mounted accessories.
  - 2. Hardware items which are permitted to be installed in the field include:
    - a. Door stops (wall, floor, other mounting).
    - b. Frame mounted closer brackets.
    - c. Lock and latch strike plates.
    - d. Frame wiring cables.
  - 3. Bench test shop installed work. This includes both mechanical and electrical components. Replace defective items.
  - 4. Ship field installed hardware items clearly labeled with the door number and attached to the door using shrink wrap. Include all templates and instructions which are required to complete the installation.
- B. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
- 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- C. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
- 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  - 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
  - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
  - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- D. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- E. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
- F. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

- G. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

### 3.4 FIELD QUALITY CONTROL

- A. Maintenance manual must be provided for tornado/hurricane storm shelter impact protective systems.
- B. Fire Door Assembly Inspection: Reference Division 01 Sections "Closeout Procedures". Conduct an initial fire door assembly inspection, including documentation reporting, upon completion of door hardware installation according to NFPA 80 Standard for Fire Doors and Other Opening Protectives, paragraph 5.2.4, requirements.

### 3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

### 3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

### 3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

### 3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Manufacturer's Abbreviations:

Code	Name
AD	Adams Rite
GL	Glynn-Johnson
HA	Hager
IV	Ives
LC	LCN Closers
PE	Pemko
RO	Rockwood
SC	Schlage
SN	Securitron
VO	Von Duprin
ZE	Zero

3.9

A. Hardware Sets:

**Set #01 - SLIDING DOORS**

Doors: 100A, 100B, 101A

1 HARDWARE BY OTHERS ALL HARDWARE BY OTHER

**Set #02 - EXT EGRESS - PR - ALUM - EAC**

2 - 3' 0" x 7' 0"

Doors: 123A

## Set #02 - EXT EGRESS - PR - ALUM - EAC

2	Continuous Hinge	780-111 83"	CLR	HA
1	Aluminum Mullion	5654 84"	US28	VO
1	Exit Device	98L x 996L-R&V 03	US26D	VO
1	Exit Device	98L-DT x 996L-DT 03	US26D	VO
1	Rim Cylinder	20-021	626	SC
1	Electric Strike	6300	US32D	VO
2	Closer	1461 CUSH	AL	LC
1	Wiring Diagram	BY ACCESS CONTROL PROVIDER		
1	Power Supply	AQD1-4F2		SN
1	Card Reader	BY ACCESS CONTROL PROVIDER		
1	Weatherstripping	BY DOOR MANUFACTURER		
2	Door Sweep	381A 36"		ZE
1	Threshold	2005 AT 72"		PE

## Set #03 - EXT EGRESS - ALUM - EAC

3' 3" x 7' 0"

Doors: 118A

1	Continuous Hinge	780-111 83"	CLR	HA
1	Exit Device	98L x 996L-R&V 03	US26D	VO
1	Rim Cylinder	20-021	626	SC
1	Electric Strike	6300	US32D	VO
1	Closer	1461 CUSH	AL	LC
1	Wiring Diagram	BY ACCESS CONTROL PROVIDER		
1	Power Supply	AQD1-4F2		SN
1	Card Reader	BY ACCESS CONTROL PROVIDER		
1	Weatherstripping	BY DOOR MANUFACTURER		
1	Door Sweep	381A 36"		ZE
1	Threshold	2005 AT 72"		PE

## Set #04 - EXT EGRESS - EAC

3' 3" x 7 1½"

Doors: 106B, 110C, 131A, 137A

1	Continuous Hinge	780-111 83"	CLR	HA
1	Exit Device	98L x 996L-R&V 03	US26D	VO
1	Rim Cylinder	20-021	626	SC
1	Electric Strike	6300	US32D	VO
1	Closer	1461 CUSH	AL	LC
1	Wiring Diagram	BY ACCESS CONTROL PROVIDER		
1	Power Supply	AQD1-4F2		SN
1	Card Reader	BY ACCESS CONTROL PROVIDER		
1	Weatherstripping	BY DOOR MANUFACTURER		
1	Door Sweep	381A 36"		ZE
1	Threshold	2005 AT 72"		PE

## Set #05 - EXT RISER ROOM

3' 3" x 7 1½"

Doors: 102A

1 Continuous Hinge	780-111 83"	CLR	HA
1 Mortise Storeroom Lockset	L9080P 03A	626	SC
1 Closer	1461 HCUSH	AL	LC
1 Weatherstripping	BY DOOR MANUFACTURER		
1 Door Bottom	315 CN 36"		PE
1 Threshold	171 A 72"		PE

## Set #06 - BOOK DROP - RATED

3' 0" x 7' 0" x 90

Doors: 142A

3 Hinges	5BB1 4 1/2 x 4 1/2	626	IV
1 Mortise Classroom Lockset	L9070P 03A	626	SC
1 Closer	1461 RWPA	AL	LC
1 Wall Bumper	WS401/402CCV	US26D	IV
1 Protection Plate	8400 8" x 2" LDW	US32D	IV
1 Smoke Seal	S88 BL 25'		PE

## Set #07 - ELECTRICAL

3' 0" x 7' 0"

Doors: E1A

3 Hinges	5BB1 4 1/2 x 4 1/2	626	IV
1 Exit Device	98L x 996L-R&V 03	US26D	VO
1 Rim Cylinder	20-021	626	SC
1 Closer	1461 CUSH	AL	LC

## Set #08 – MULTI-PURPOSE - EAC

3' 0" x 7' 0"

Doors: 110A

3 Hinges	5BB1 HW 4 1/2 x 4 1/2	626	IV
1 Mortise Storeroom Lockset	L9080P 03A	626	SC
1 Electric Strike	6211	US32D	VO
1 Closer	1461 RWPA	AL	LC
1 Wall Bumper	WS401/402CCV	US26D	IV
1 Protection Plate	8400 8" x 2" LDW	US32D	IV
1 Wiring Diagram	BY ACCESS CONTROL PROVIDER		
1 Power Supply	AQD1-4F2		SN
1 Card Reader	BY ACCESS CONTROL PROVIDER		

## Set #09 - MULTI-PURPOSE PR - EAC

2 - 3' 0" x 7' 0"

Doors: 110B, 114B

6 Hinges	5BB1 4 1/2 x 4 1/2	626	IV
1 Aluminum Mullion	5654 84"	US28	VO
1 Exit Device	98L x 996L-R&V 03	US26D	VO
1 Exit Device	98L-DT x 996L-DT 03	US26D	VO
1 Rim Cylinder	20-021	626	SC
1 Electric Strike	6300	US32D	VO
2 Closer	1461 RWPA	AL	LC
2 Protection Plate	8400 8" x 2" LDW	US32D	IV
1 Wiring Diagram	BY ACCESS CONTROL PROVIDER		
1 Power Supply	AQD1-4F2		SN
1 Card Reader	BY ACCESS CONTROL PROVIDER		

## Set #10 – MEETING - EAC

3' 0" x 7' 0"

Doors: 106A

3 Hinges	5BB1 HW 4 1/2 x 4 1/2	626	IV
1 Exit Device	98L x 996L-R&V 03	US26D	VO
1 Rim Cylinder	20-021	626	SC
1 Electric Strike	6300	US32D	VO
1 Closer	1461 RWPA	AL	LC
1 Wall Bumper	WS401/402CCV	US26D	IV
1 Wiring Diagram	BY ACCESS CONTROL PROVIDER		
1 Power Supply	AQD1-4F2		SN
1 Card Reader	BY ACCESS CONTROL PROVIDER		

## Set #11 – STAFF ROOMS

3' 0" x 7' 0"

Doors: 134A, 135A, 141A

3 Hinges	5BB1 4 1/2 x 4 1/2	626	IV
1 Mortise Classroom Lockset	L9070P 03A	626	SC
1 Protection Plate	8400 8" X 2" LDW	US32D	IV
1 Wall Bumper	WS401/402CCV	US26D	IV

NOTE: No Protection Plate at 134A and 141A

## Set #12 - KITCHENETTE

3' 0" x 7' 0"

Doors: 108A, 108B

## Pender County Library, Hampstead Branch

### Set #12 - KITCHENETTE

3 Hinges	5BB1 4 1/2 x 4 1/2	626	IV
1 Mortise Passage Set	L9010 03A	626	SC
2 Protection Plate	8400 8" X 2" LDW	US32D	IV
1 Wall Bumper	WS401/402CCV	US26D	IV

### Set #13 - RESTROOM

3' 0" x 7' 0"

Doors: 104A, 105A

3 Hinges	5BB1 HW 4 1/2 x 4 1/2	626	IV
1 Door Pull	8303 10" 4" x 16" F Mount	US32D	IV
1 Push Plate	8200 6" x 16"	US32D	IV
1 Closer	1461 RWPA	AL	LC
1 Protection Plate	8400 8" X 2" LDW	US32D	IV

### Set #14 - OFFICE - EAC

3' 0" x 7' 0"

Doors: 137B, 143A, D1A

3 Hinges	5BB1 HW 4 1/2 x 4 1/2	626	IV
1 Mortise Storeroom Lockset	L9080P 03A	626	SC
1 Electric Strike	6211	US32D	VO
1 Closer	1461 RWPA	AL	LC
1 Wall Bumper	WS401/402CCV	US26D	IV
1 Wiring Diagram	BY ACCESS CONTROL PROVIDER		
1 Power Supply	AQD1-4F2		SN
1 Card Reader	BY ACCESS CONTROL PROVIDER		

### Set #15 - STORAGE

3' 8" x 7' 0"

Doors: 107A, 107B

4 Hinges	5BB1 4 1/2 x 4 1/2	626	IV
1 Mortise Passage Set	L9010 03A	626	SC
2 Protection Plate	8400 8" x 2" LDW	US32D	IV
1 Crash Stop	CS115 30 1/2"	US26D	IV

### Set #16 - STOR PR

2 - 3' 0" x 7' 0"

Doors: 114A

### Set #16 - STOR PR

6 Hinges	5BB1 4 1/2 x 4 1/2	626	IV
2 Flush Bolt	FB458	US26D	IV
1 Strike	DP2	US26D	IV
1 Mortise Classroom Lockset	L9070P 03A	626	SC
2 Crash Stop	CS115 30 1/2"	US26D	IV

### Set #17 - JANITOR

3' 0" x 7' 0"

Doors: 111A, 111B

3 Hinges	5BB1 4 1/2 x 4 1/2	626	IV
1 Mortise Storeroom Lockset	L9080P 03A	626	SC
1 Protection Plate	8400 8" X 2" LDW	US32D	IV
1 Wall Bumper	WS401/402CCV	US26D	IV

### Set #18 - WORK / OFFICE

3' 0" x 7' 0"

Doors: 109A, 136A, 139A, 140A

3 Hinges	5BB1 4 1/2 x 4 1/2	626	IV
1 Mortise Entrance/Office Lockset	L9050P 03A	626	SC
1 Wall Bumper	WS401/402CCV	US26D	IV

### Set #19 – TOILET / NURSING

3' 0" x 7' 0"

Doors: 103A, 115A, 116A, 138A

3 Hinges	5BB1 4 1/2 x 4 1/2	626	IV
1 Mortise Privacy Set	L9044 03A OS-OCC	626	SC
1 Wall Bumper	WS401/402CCV	US26D	IV
1 Coat Hook	510C	626	IV

### Set #20 - CONF / MEETING

3' 0" x 7' 0"

Doors: 120A, 121A, 127A, 128A, 129A, 130A, 132A, 133A

3 Hinges	5BB1 4 1/2 x 4 1/2	626	IV
1 Mortise Passage Set	L9010 03A	626	SC
1 Wall Bumper	WS401/402CCV	US26D	IV

### Set #21 - CONF / MEETING [OHS]

3' 0" x 7' 0"

**Set #21 - CONF / MEETING [OHS]**

Doors: 124A

3 Hinges	5BB1 4 1/2 x 4 1/2	626	IV
1 Mortise Passage Set	L9010 03A	626	SC
1 Overhead Stop	454S	652	GL

END OF SECTION 087100

## **SECTION 08 8000 GLAZING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Insulating glass units.
- B. Glazing units.
- C. Laminated glass interlayers.
- D. Glazing compounds.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 07 2700 - Air Barriers.
- B. Section 07 9200 - Joint Sealants: Sealants for other than glazing purposes.
- C. Section 08 1416 - Flush Wood Doors: Doors to receive glazing.
- D. Section 08 4229 - Automatic Entrances: Door assemblies to receive glazing.
- E. Section 08 4313 - Aluminum-Framed Storefronts: Storefront framing and storefront doors to receive glazing.
- F. Section 08 4413 - Glazed Aluminum Curtain Walls: Curtain wall framing to receive glazing.
- G. Section 10 2800 - Toilet, Bath, and Laundry Accessories: Mirrors.

#### **1.03 REFERENCE STANDARDS**

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
- C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).
- E. ASTM C1036 - Standard Specification for Flat Glass; 2021.
- F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- G. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.
- H. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.
- I. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.
- J. ASTM E413 - Classification for Rating Sound Insulation; 2022.
- K. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.
- L. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2023.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

#### **1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.

- B. Product Data on Insulating Glass Unit, Glazing Unit, and Laminated Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Samples: Submit one sample 12 by 12 inch in size for each glazing type.
- E. Installer's qualification statement.
- F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

#### **1.06 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

#### **1.07 FIELD CONDITIONS**

- A. Do not install glazing when ambient temperature is less than 40 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

#### **1.08 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.
- C. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Float Glass Manufacturers:
  1. AGC Inc.: [www.agc.com](http://www.agc.com).
  2. Cardinal Glass Industries: [www.cardinalcorp.com/#sle](http://www.cardinalcorp.com/#sle).
  3. Guardian Glass, LLC: [www.guardianglass.com/#sle](http://www.guardianglass.com/#sle).
  4. Pilkington North America Inc: [www.pilkington.com/na/#sle](http://www.pilkington.com/na/#sle).
  5. Saint Gobain North America: [www.saint-gobain.com/#sle](http://www.saint-gobain.com/#sle).
  6. Vitro Architectural Glass (formerly PPG Glass): [www.vitroglazings.com/#sle](http://www.vitroglazings.com/#sle).
  7. Substitutions: See Section 01 6000 - Product Requirements.
- B. Obscure - Patterned Glass Manufacturers:
  1. AGC Inc.: [www.agc.com](http://www.agc.com).
  2. GGI - General Glass International: [www.generalglass.com/#sle](http://www.generalglass.com/#sle).
  3. Oldcastle Building Envelope: [www.obe.com/#sle](http://www.obe.com/#sle).
  4. Substitutions: See Section 01 6000 - Product Requirements.

#### **2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES**

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
  1. Design Pressure: Calculated in accordance with ASCE 7 and as indicated on Structural drawings.
  2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
  3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.

4. Glass thicknesses listed are minimum.
- B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
  1. In conjunction with weather barrier related materials described in other sections, as follows:
    - a. Air Barriers: See Section 07 2700.
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
  1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
  2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
  3. Solar Optical Properties: Comply with NFRC 300 test method.

### **2.03 GLASS MATERIALS**

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
  1. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
  2. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
  3. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality - Q3, with color and performance characteristics as indicated.
  4. Patterned Glass Type: ASTM C1036, Type II - Patterned Flat Glass, Form 3 - Patterned glass, with color and performance characteristics as indicated.
  5. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.
- B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
  1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.
  2. Acoustical Polyvinyl Butyral (PVB) Interlayer: Thickness as indicated in glazing unit description.

### **2.04 BASIS OF DESIGN - INSULATING GLASS UNITS**

- A. Basis of Design Type IG-1 - Insulating Glass Units: Vision glazing, with low-e coating.
  1. Applications: Exterior insulating glass glazing, clear, at locations indicated on drawings.
  2. Space between lites filled with argon.
  3. Total Thickness: 1 inch.
  4. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.24, nominal.
  5. Visible Light Transmittance (VLT): 51 percent, nominal.
  6. Solar Heat Gain Coefficient (SHGC): 0.23, nominal.
  7. Visible Light Reflectance, Outside: 12 percent, nominal.
  8. Glazing Method: Dry glazing method, gasket glazing.
  9. Metal Edge Spacers: Aluminum, bent and soldered corners.
  10. Spacer Color: Black.
  11. Edge Seal:
    - a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
  12. Color: Black.
  13. Purge interpane space with dry air, hermetically sealed.
  14. Basis of Design - Vitro Architectural Glass (formerly PPG Glass):
 

[www.vitroglazings.com/#sle](http://www.vitroglazings.com/#sle).

    - a. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.

- b. Low-E Coating: Vitro Architectural Glass (formerly PPG Glass) Solarban 90 on #2 surface.
    - c. Glass: Clear.
  - 15. Inboard Lite: Fully tempered float glass, 1/4 inch thick.
    - a. Coating: No coating on inboard lite.
    - b. Glass: Clear.
- B. Basis of Design Type IG-2 - Insulating Glass Units: Vision glazing, with low-e coating.
  - 1. Applications: Exterior insulating glass glazing, tinted, at locations indicated on drawings.
  - 2. Space between lites filled with argon.
  - 3. Total Thickness: 1 inch.
  - 4. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.24, nominal.
  - 5. Visible Light Transmittance (VLT): 26 percent, nominal.
  - 6. Solar Heat Gain Coefficient (SHGC): 0.17, nominal.
  - 7. Visible Light Reflectance, Outside: 6 percent, nominal.
  - 8. Glazing Method: Dry glazing method, gasket glazing.
  - 9. Metal Edge Spacers: Aluminum, bent and soldered corners.
  - 10. Spacer Color: Black.
  - 11. Edge Seal:
    - a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
  - 12. Color: Black.
  - 13. Purge interpane space with dry air, hermetically sealed.
  - 14. Basis of Design - Vitro Architectural Glass (formerly PPG Glass): [www.vitroglazings.com/#sle](http://www.vitroglazings.com/#sle).
  - 15. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
    - a. Low-E Coating: Vitro Architectural Glass (formerly PPG Glass) Solarban 90 on #2 surface.
    - b. Glass Tint: Solargray (medium-gray).
  - 16. Inboard Lite: Fully tempered float glass, 1/4 inch thick.
    - a. Coating: No coating on inboard lite.
    - b. Glass: Clear.
- C. Basis of Design Type IG-3 - Insulating Glass Units: Vision glazing, with low-e coating.
  - 1. Applications: Exterior sound control insulating glass glazing, clear, at locations indicated on drawings.
  - 2. Space between lites filled with argon.
  - 3. Sound Transmission Class (STC) Rating: STC 42 rating, complying with ASTM E90 and ASTM E413.
  - 4. Total Thickness: 1-5/16 inch.
  - 5. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.24, nominal.
  - 6. Visible Light Transmittance (VLT): 51 percent, nominal.
  - 7. Solar Heat Gain Coefficient (SHGC): 0.23, nominal.
  - 8. Visible Light Reflectance, Outside: 12 percent, nominal.
  - 9. Glazing Method: Dry glazing method, gasket glazing.
  - 10. Purge interpane space with dry air, hermetically sealed.
  - 11. Basis of Design - Vitro Architectural Glass (formerly PPG Glass): [www.vitroglazings.com/#sle](http://www.vitroglazings.com/#sle).
  - 12. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
    - a. Low-E Coating: Vitro Architectural Glass (formerly PPG Glass) Solarban 90 on #2 surface.
  - 13. Laminated Inboard Lite:
    - a. Outer Ply: Annealed float glass, 1/4 inch thick, clear.
    - b. Interlayer: PVB, 0.060 inch thickness, acoustical, clear.

- c. Inner Ply: Annealed float glass, 1/4 inch thick, clear.
- D. Basis of Design Type IG-4 - Insulating Glass Units: Vision glazing, with low-e coating.
  - 1. Applications: Exterior sound control insulating glass glazing, tinted, at locations indicated on drawings.
  - 2. Space between lites filled with argon.
  - 3. Sound Transmission Class (STC) Rating: STC 42 rating, complying with ASTM E90 and ASTM E413.
  - 4. Total Thickness: 1-5/16 inch.
  - 5. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.24, nominal.
  - 6. Visible Light Transmittance (VLT): 26 percent, nominal.
  - 7. Solar Heat Gain Coefficient (SHGC): 0.17, nominal.
  - 8. Visible Light Reflectance, Outside: 6 percent, nominal.
  - 9. Glazing Method: Dry glazing method, gasket glazing.
  - 10. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
  - 11. Metal Edge Spacers: Aluminum, bent and soldered corners.
  - 12. Spacer Color: Black.
  - 13. Edge Seal:
    - a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
  - 14. Color: Black.
  - 15. Purge interpane space with dry air, hermetically sealed.
  - 16. Basis of Design - Vitro Architectural Glass (formerly PPG Glass):  
[www.vitroglazings.com/#sle](http://www.vitroglazings.com/#sle).
  - 17. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
    - a. Low-E Coating: Vitro Architectural Glass (formerly PPG Glass) Solarban 90 on #2 surface.
    - b. Glass Tint: Solargray (medium-gray).
  - 18. Laminated Inboard Lite:
    - a. Outer Ply: Annealed float glass, 1/4 inch thick, clear.
    - b. Interlayer: PVB, 0.060 inch thickness, acoustical, clear.
    - c. Inner Ply: Annealed float glass, 1/4 inch thick, clear.
- E. Basis of Design Type IG-5 - Insulating Glass Units: Obscure-patterned glazing, with low-e coating.
  - 1. Applications: Exterior insulating glass glazing, tinted, at locations indicated on drawings.
  - 2. Space between lites filled with argon.
  - 3. Total Thickness: 1 inch, nominal.
  - 4. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.24, nominal.
  - 5. Visible Light Transmittance (VLT): 26 percent, nominal.
  - 6. Solar Heat Gain Coefficient (SHGC): 0.17, nominal.
  - 7. Visible Light Reflectance, Outside: 6 percent, nominal.
  - 8. Glazing Method: Dry glazing method, gasket glazing.
  - 9. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
  - 10. Metal Edge Spacers: Aluminum, bent and soldered corners.
  - 11. Spacer Color: Black.
  - 12. Edge Seal:
    - a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.

13. Color: Black.
14. Purge interpane space with dry air, hermetically sealed.
15. Basis of Design - Vitro Architectural Glass (formerly PPG Glass):  
[www.vitroglazings.com/#sle](http://www.vitroglazings.com/#sle).
16. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
  - a. Low-E Coating: Vitro Architectural Glass (formerly PPG Glass) Solarban 90 on #2 surface.
  - b. Glass Tint: Solargray (medium-gray).
17. Inboard Lite: Fully tempered obscure patterned glass, nominal 1/4 inch thick.
  - a. Coating: No coating on inboard lite.
  - b. Glass: Clear.
18. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of another acceptable manufacturer.
19. Substitution Procedures: See Section 01 6000 - Product Requirements.
  - a. For any product not identified as "Basis of Design", submit information as specified for substitutions.

## **2.05 GLAZING UNITS**

- A. Type G-1 - Monolithic Interior Safety Glazing: Non-fire-rated.
  1. Applications:
    - a. Glazed lites in interior doors, except fire doors.
    - b. Glazed sidelights to doors, except in fire-rated walls and partitions.
    - c. Other locations indicated on drawings.
  2. Glass Type: Fully tempered safety glass as specified.
  3. Tint: Clear.
  4. Thickness: 1/4 inch, nominal.
- B. Type G-2 - Sound Control Safety Glazing: Laminated monolithic glass.
  1. Applications: Locations as indicated on drawings.
  2. Tint: Clear.
  3. Sound Transmission Class (STC) Rating: STC 38 rating, complying with ASTM E90 and ASTM E413.
  4. Overall Thickness: 1/2 inch nominal.
  5. Laminated Monolithic Glass:
    - a. Outer Layer: Heat-strengthened glass.
      - 1) Thickness: 1/4 inch.
    - b. Interlayer: Polyvinyl butyral (PVB), 0.030 inch thickness.
    - c. Inner Layer: Heat-strengthened glass.
      - 1) Thickness: 1/4 inch.

## **2.06 LAMINATED GLASS INTERLAYERS**

- A. Sound Control Polyvinyl Butyral (PVB) Interlayer for Laminated Glazing:
  1. Functionality: Post-breakage safety and sound control.
  2. Applications:
    - a. Single pane, laminated glass unit, Type G-2.
    - b. Interior laminated pane of insulating glass unit, Type IG-3 and IG-4.
  3. Color: Clear.
  4. Thickness: As indicated in glazing unit descriptions.
  5. Manufacturers:
    - a. Eastman Chemical Company; Saflex Acoustic PVB Interlayer: [www.saflex.com/#sle](http://www.saflex.com/#sle).
    - b. Kuraray America, Inc; Trosifol Sound Control (SC): [www.kuraray.us.com/#sle](http://www.kuraray.us.com/#sle).
    - c. Sekisui S-LEC America, LLC; S-LEC Sound Acoustic Film: [www.s-lec.us/#sle](http://www.s-lec.us/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.

## **2.07 ACCESSORIES**

- A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II.  
Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II.  
Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.

**END OF SECTION 08 8000**

**SECTION 08 9200**  
**LOUVERED EQUIPMENT ENCLOSURES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Louvered aluminum screens.

**1.02 RELATED REQUIREMENTS**

- A. Section 05 1200 - Structural Steel Framing: Superstructure support and bracing of rooftop screens.
- B. Section 05 5000 - Metal Fabrications: Superstructure support and bracing of rooftop screens.

**1.03 REFERENCE STANDARDS**

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Storage and handling requirements and recommendations.
  - 2. Installation methods.
- C. Shop Drawings: Include plans, sections, and details of connections and bracing.
  - 1. Include structural calculations indicating compliance with wind loading requirements.
- D. Selection Samples: One complete set of color chips or original hardcopy of printed color card representing manufacturer's full range of available colors for each product.
- E. Verification Samples: One physical sample representing selected finish color and texture.
- F. Specimen warranty.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Comply with manufacturer's instructions for handling of screen products.

**1.06 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Aluminum Finish Warranty: Provide 10-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Louvered Equipment Screens:
  - 1. American Warming and Ventilating; LS-47: [www.awv.com/#sle](http://www.awv.com/#sle).
  - 2. Architectural Louvers Co.; V4JS : [www.archlouvers.com](http://www.archlouvers.com).
  - 3. Industrial Louvers, Inc; 450XPI: [www.industriallouvers.com/#sle](http://www.industriallouvers.com/#sle).
  - 4. Ruskin Company; EV811: [www.ruskin.com/#sle](http://www.ruskin.com/#sle).

5. Substitutions: See Section 01 6000 - Product Requirements.

## **2.02 APPLICATIONS**

- A. Screens for concealing rooftop equipment.

## **2.03 PERFORMANCE REQUIREMENTS**

- A. Wind Resistance: Design louvered screens to withstand positive and negative wind loading in accordance with loads indicated on drawings.

## **2.04 EXTRUDED HORIZONTAL LOUVERED SCREENS**

- A. Overall Screen Configuration: Dimensions, details, and layout as indicated on drawings.
- B. Construction: Individual extruded aluminum louvers in inverted overlapping configuration, with blade supports attached to and supported by customized support structure.
1. Louver Blades: Alloy 6063-T5 or T6 temper, or equivalent in accordance with ASTM B221 (ASTM B221M), 0.081 inch thick minimum, 4 inch deep, spaced at 5 inch on center, and configured to totally block sightlines from grade.
- C. Aluminum Finish: Factory finish louvers and accessories using system indicated below.
1. Color: As selected from manufacturer's standard colors.

## **2.05 ALUMINUM FINISHES**

- A. Superior Performing Organic Coatings System: Manufacturer's standard multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch.
- B. Touch-Up Materials: As recommended by coating manufacturer for field application.

## **2.06 ACCESSORIES**

- A. Miscellaneous Trim: ASTM B209/B209M aluminum sheet, alloy 3005-H25 temper, or equivalent, formed to shapes indicated and finished to match other components.
- B. Support Structure: See Section 05 5000.
- C. Fasteners: Self-tapping stainless steel screws, as approved by manufacturer of equipment screens.

# **PART 3 EXECUTION**

## **3.01 EXAMINATION**

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

## **3.02 PREPARATION**

- A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

## **3.03 INSTALLATION**

- A. Install equipment screens in accordance with manufacturer's printed instructions and as indicated on shop drawings.
- B. Form tight joints and fit exposed connections accurately.
- C. Provide necessary fastenings and anchors required for a complete installation, and install units plumb, level, and in proper alignment with adjacent work.

## **3.04 PROTECTION**

- A. Protect installed products until completion of project.

- B. Protect metal surfaces from corrosion or galvanic action by application of a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry or dissimilar metals. Allow paint to dry before assembly.
- C. Touch-up, repair, or replace damaged products before Date of Substantial Completion.

**END OF SECTION 08 9200**

**SECTION 09 0561  
COMMON WORK RESULTS FOR FLOORING PREPARATION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
  - 1. Resilient tile.
  - 2. Carpet tile.
  - 3. Thin-set ceramic tile and stone tile.
- B. Preparation of new concrete floor slabs for installation of floor coverings.
- C. Testing of concrete floor slabs for moisture and alkalinity (pH).
- D. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
  - 1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.
- E. Patching compound.
- F. Remedial floor coatings.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete: Limitations on curing requirements for new concrete floor slabs.

**1.03 REFERENCE STANDARDS**

- A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm [2 in.] Cube Specimens); 2023.
- B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
- C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.
- D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

**1.04 SUBMITTALS**

- A. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
  - 1. Moisture and alkalinity (pH) limits and test methods.
  - 2. Manufacturer's required bond/compatibility test procedure.
- B. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
  - 1. Manufacturer's installation instructions.
- C. Testing Agency's Report:
  - 1. Description of areas tested; include floor plans and photographs if helpful.
  - 2. Summary of conditions encountered.
  - 3. Moisture and alkalinity (pH) test reports.
  - 4. Copies of specified test methods.
  - 5. Recommendations for remediation of unsatisfactory surfaces.
  - 6. Product data for recommended remedial coating.
  - 7. Submit report to Architect.
  - 8. Submit report not more than two business days after conclusion of testing.

- D. Adhesive Bond and Compatibility Test Report.

#### **1.05 QUALITY ASSURANCE**

- A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.
- B. Contractor may perform adhesive and bond test with Contractor's own personnel or hire a testing agency.
- C. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
  - 1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
- D. Contractor's Responsibility Relating to Independent Agency Testing:
  - 1. Provide access for and cooperate with testing agency.
  - 2. Confirm date of start of testing at least 10 days prior to actual start.
  - 3. Allow at least 4 business days on site for testing agency activities.
  - 4. Achieve and maintain specified ambient conditions.
  - 5. Notify Architect when specified ambient conditions have been achieved and when testing will start.
- E. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

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

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.

#### **1.07 FIELD CONDITIONS**

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.
- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
  - 1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
  - 2. Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
  - 3. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.
- B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.

- C. Remedial Floor Coating, Two-Component: Single-layer coating resistant to water vapor transmission meeting flooring manufacturer's emission limits, resistant to alkalinity (pH) level found, and suitable for flooring adhesion without further treatment.
  - 1. Thickness: As required for application and in accordance with manufacturer's installation instructions.

## **PART 3 EXECUTION**

### **3.01 CONCRETE SLAB PREPARATION**

- A. Perform following operations in the order indicated:
  - 1. Preliminary cleaning.
  - 2. Moisture vapor emission tests; 3 tests in the first 5000 square feet and one test in each additional 5000 square feet, unless otherwise indicated or required by flooring manufacturer.
  - 3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
  - 4. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
  - 5. Specified remediation, if required.
  - 6. Patching, smoothing, and leveling, as required.
  - 7. Other preparation specified.
  - 8. Adhesive bond and compatibility test.
- B. Remediations:
  - 1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
  - 2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
  - 3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

### **3.02 PRELIMINARY CLEANING**

- A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
- B. Do not use solvents or other chemicals for cleaning.

### **3.03 MOISTURE VAPOR EMISSION TESTING**

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F1869 and as follows.
- D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.
- F. Report: Report the information required by the test method.

### **3.04 INTERNAL RELATIVE HUMIDITY TESTING**

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F2170 Procedure A and as follows.
- D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.
- F. Report: Report the information required by the test method.

### **3.05 ALKALINITY TESTING**

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
  - 1. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
  - 2. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.
  - 3. Use of a digital pH meter with probe is acceptable; follow meter manufacturer's instructions.
- C. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

### **3.06 PREPARATION**

- A. See individual floor covering section(s) for additional requirements.
- B. Comply with requirements and recommendations of floor covering manufacturer.
- C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
- D. Do not fill expansion joints, isolation joints, or other moving joints.

### **3.07 ADHESIVE BOND AND COMPATIBILITY TESTING**

- A. Comply with requirements and recommendations of floor covering manufacturer.

### **3.08 APPLICATION OF REMEDIAL FLOOR COATING**

- A. Comply with requirements and recommendations of coating manufacturer.

**END OF SECTION 09 0561**

**SECTION 09 2116  
GYPSUM BOARD ASSEMBLIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Performance criteria for gypsum board assemblies.
- B. Resilient sound isolation clips.
- C. Gypsum wallboard.
- D. Joint treatment and accessories.
- E. Acoustic (sound-dampening) wall and ceiling board.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Building framing and sheathing.
- B. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.
- C. Section 07 2100 - Thermal Insulation: Acoustic insulation.
- D. Structural Drawings: Additional requirements for building framing and sheathing.

**1.03 REFERENCE STANDARDS**

- A. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.
- B. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.
- C. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).
- D. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- E. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2023.
- F. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.
- G. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.
- H. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2018.
- I. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
- J. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
- K. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.
- L. ASTM E413 - Classification for Rating Sound Insulation; 2022.
- M. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate the installation of gypsum board assemblies with size, location, and installation of service utilities.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- C. Sequencing: Install service utilities in an orderly and expeditious manner.

## **1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data:
  - 1. Provide data on metal framing, gypsum board, glass mat faced gypsum board, accessories, joint finishing system, and sound isolation clips.

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

- A. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.

## **PART 2 PRODUCTS**

### **2.01 GYPSUM BOARD ASSEMBLIES**

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
  - 1. See PART 3 for finishing requirements.
- B. Fire-Resistance-Rated Assemblies: Provide completed assemblies with the following characteristics:
  - 1. Fire-Resistance-Rated Partitions: As indicated on drawings.

### **2.02 METAL FRAMING MATERIALS**

- A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.
- B. Nonstructural Framing System Components: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf.
  - 1. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch.
  - 2. Resilient Sound Isolation Clips: Steel resilient clips with molded rubber isolators, attaches to framing; improves noise isolation performance of wall assemblies.
    - a. Products:
      - 1) Acoustical Solutions; Whisper Clip: [www.acousticalsolutions.com](http://www.acousticalsolutions.com).
      - 2) ClarkDietrich; Sound Clip (CDSC): [www.clarkdietrich.com/#sle](http://www.clarkdietrich.com/#sle).
      - 3) Green Glue Company; Noiseproofing Clips: [www.greengluecompany.com](http://www.greengluecompany.com).
      - 4) PAC International, Inc; RSIC-1: [www.pac-intl.com/#sle](http://www.pac-intl.com/#sle).
      - 5) Trademark Soundproofing; MarvelMute Clips : [www.tmsoundproofing.com](http://www.tmsoundproofing.com).
      - 6) Substitutions: See Section 01 6000 - Product Requirements.

### **2.03 BOARD MATERIALS**

- A. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
  - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
  - 2. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
  - 3. Surface Burning Characteristics: Class A, Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
  - 4. Thickness:
    - a. Vertical Surfaces: 5/8 inch.
    - b. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
  - 5. Mold-Resistant, Paper-Faced Products:
    - a. CertainTeed Corporation; M2Tech 5/8" Type X Moisture & Mold Resistant Drywall: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
    - b. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
    - c. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Fire-Shield Gypsum Board: [www.goldbondbuilding.com/#sle](http://www.goldbondbuilding.com/#sle).
    - d. PABCO Gypsum; MOLD CURB Plus Type X: [www.pabcogypsum.com/#sle](http://www.pabcogypsum.com/#sle).

- e. USG Corporation; Sheetrock Brand EcoSmart Panels Mold Tough Firecode X 5/8 in. (15.9 mm): [www.usg.com/#sle](http://www.usg.com/#sle).
  - f. Substitutions: See Section 01 6000 - Product Requirements.
- B. Backing Board:
  - 1. Application: Surfaces behind tile<>.
  - 2. Surface Burning Characteristics: Class A, Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
  - 3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  - 4. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
    - a. Products:
      - 1) CertainTeed Corporation; 5/8" GlasRoc Tile Backer Type X: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
      - 2) Georgia-Pacific Gypsum; DensShield Tile Backer: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
      - 3) Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Fire-Shield Tile Backer: [www.goldbondbuilding.com/#sle](http://www.goldbondbuilding.com/#sle).
      - 4) USG Corporation; Durock Brand Glass-Mat Tile Backerboard SGX 5/8 in. (15.9 mm): [www.usg.com/#sle](http://www.usg.com/#sle).
      - 5) Substitutions: See Section 01 6000 - Product Requirements.
- C. Acoustical Sound-Dampening Wall and Ceiling Board: Two layers of heavy paper-faced, high-density gypsum board separated by a viscoelastic polymer layer and capable of achieving STC rating of 50 or more in typical stud wall assemblies as calculated in accordance with ASTM E413 and when tested in accordance with ASTM E90.
  - 1. Thickness: 5/8 inch.
  - 2. Long Edges: Tapered.
  - 3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  - 4. Products:
    - a. CertainTeed Corporation; SilentFX Quick Cut Type X Gypsum Board: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
    - b. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond SoundBreak XP Wall Board: [www.goldbondbuilding.com/#sle](http://www.goldbondbuilding.com/#sle).
    - c. Pabco Gypsum; Quiet Rock ESMR Type X: [www.pabco gypsum.com](http://www.pabco gypsum.com).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
- D. Exterior Sheathing Board: See Section 06 1000.

## **2.04 GYPSUM BOARD ACCESSORIES**

- A. Acoustic Insulation: See Section 07 2100.
- B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
- C. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.
  - 1. Corner Beads: Low profile, for 90 degree outside corners.
  - 2. L-Trim with Tear-Away Strip: Sized to fit 5/8-inch thick gypsum wallboard.
  - 3. Expansion Joints:
    - a. Type: V-shaped PVC with tear away fins.
- D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
- E. Screws for Fastening of Gypsum Panel Products to Wood and Light Gauge Steel Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that project conditions are appropriate for work of this section to commence.

### **3.02 FRAMING INSTALLATION**

- A. Metal Framing: Install in accordance with ASTM C1007/AISI S220 and manufacturer's instructions.
- B. Acoustic Furring: Install resilient channels at maximum 24 inches on center. Locate joints over framing members.
- C. Resilient Sound Isolation Clips: Install resilient sound isolation clips, and where applicable, associated furring sections and channels, in accordance with clip manufacturer's written instructions.

### **3.03 ACOUSTIC ACCESSORIES INSTALLATION**

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install as follows:
  - 1. Place one bead continuously on substrate before installation of perimeter framing members.
  - 2. Place continuous bead at perimeter of each layer of gypsum board.
  - 3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

### **3.04 BOARD INSTALLATION**

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
- C. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- D. Installation on Metal Framing: Use screws for attachment of gypsum board.
- E. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority. For nonrated assemblies, install as follows:
  - 1. Single-Layer Applications: Screw attachment.

### **3.05 INSTALLATION OF TRIM AND ACCESSORIES**

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
  - 1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

### **3.06 JOINT TREATMENT**

- A. Glass Mat Faced Gypsum Board: See Section 09 3000.
- B. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.
- C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
  - 1. Level 5: Walls and ceilings to receive paint finish and other areas unless otherwise indicated.
  - 2. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
  - 3. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.

- D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
  - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
- E. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

### **3.07 TOLERANCES**

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

### **3.08 PROTECTION**

- A. Protect installed gypsum board assemblies from subsequent construction operations.

**END OF SECTION 09 2116**

## **SECTION 09 3000 TILING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Stone thresholds.
- D. Non-ceramic trim.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 07 9200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- B. Section 09 0561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.
- C. Section 09 2116 - Gypsum Board Assemblies: Tile backer board.

#### **1.03 REFERENCE STANDARDS**

- A. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2023.
- B. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2023.
- C. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2019.
- D. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014 (Reaffirmed 2024).
- E. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2022.
- F. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products; 2018 (Reapproved 2023).
- G. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2018.
- H. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2025.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers.

#### **1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Selection Samples: Provide physical samples of tile and grout for color selection.
- D. Installer's Qualification Statement: Submit documentation of experience.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Tile: 10 square feet of each size, color, and surface finish combination.

## **1.06 QUALITY ASSURANCE**

- A. Installer Qualifications:
  - 1. Company specializing in performing tile installation, with minimum of five years of documented experience.

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

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

## **1.08 FIELD CONDITIONS**

## **PART 2 PRODUCTS**

### **2.01 TILE**

- A. Manufacturers: All products by the same manufacturer.
  - 1. American Olean Corporation: [www.americanolean.com/#sle](http://www.americanolean.com/#sle).
  - 2. Dal-Tile Corporation: [www.daltile.com/#sle](http://www.daltile.com/#sle).
  - 3. Emser Tile, LLC: [www.emser.com/#sle](http://www.emser.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Porcelain Tile, Type PT-1: ANSI A137.1 standard grade.
  - 1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
  - 2. Size: 2 by 2 inch mosaic.
  - 3. Thickness: 1/4 inch.
  - 4. Edges: Square.
  - 5. Surface Finish: Unglazed.
  - 6. Color(s): To be selected by Architect from manufacturer's standard range.
  - 7. Basis of Design Product:
    - a. Dal-Tile Corporation; Reminiscent: [www.daltile.com/#sle](http://www.daltile.com/#sle).
- C. Porcelain Tile, Type PT-2: ANSI A137.1 standard grade.
  - 1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
  - 2. Size: 12 by 24 inch, nominal.
  - 3. Thickness: 5/16 inch.
  - 4. Edges: Square.
  - 5. Surface Finish: Unglazed.
  - 6. Color(s): To be selected by Architect from manufacturer's standard range.
  - 7. Basis of Design Product:
    - a. Dal-Tile Corporation; Sand and Stone, Sand Design: [www.daltile.com/#sle](http://www.daltile.com/#sle).
- D. Porcelain Tile, Type PT-3: ANSI A137.1 standard grade.
  - 1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
  - 2. Size: 2-1/4 by 9-1/2 inch, nominal.
  - 3. Thickness: 3/8 inch.
  - 4. Edges: Square.
  - 5. Surface Finish: Glazed.
  - 6. Color(s): To be selected by Architect from manufacturer's standard range. Allow for up to two colors.
  - 7. Basis of Design Product:
    - a. Dal-Tile Corporation; Remedy: [www.daltile.com/#sle](http://www.daltile.com/#sle).

### **2.02 TRIM AND ACCESSORIES**

- A. Non-Ceramic Trim: Satin natural anodized extruded aluminum, style and dimensions to suit application, set with tile mortar.
  - 1. Applications:
    - a. Open edges of wall tile.
    - b. Outside wall corners.
  - 2. Basis of Design Product:

- a. Schluter-Systems; Profiles as indicated on drawings: [www.schluter.com](http://www.schluter.com).
- 3. Other Acceptable Manufacturers:
  - a. Blanke Corporation: [www.blankecorp.com/#sle](http://www.blankecorp.com/#sle).
  - b. Genesis APS International: [www.genesis-aps.com/#sle](http://www.genesis-aps.com/#sle).
  - c. LATICRETE International, Inc: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
  - d. Substitutions: See Section 01 6000 - Product Requirements.
- B. Thresholds: 2 inches wide by full width of wall or frame opening; beveled edge on both long edges; without holes, cracks, or open seams.
  - 1. Thickness: thickness to fit application.
  - 2. Material: Marble, honed finish.
  - 3. Color and Pattern: To coordinate with adjacent tile flooring.
  - 4. Applications:
    - a. At doorways where tile terminates.

### **2.03 SETTING MATERIALS**

- A. Provide setting and grout materials from same manufacturer.
- B. Manufacturers:
  - 1. ARDEX Engineered Cements: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
  - 2. LATICRETE International, Inc: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
  - 3. Mapei Corporation: [www.mapei.com/#sle](http://www.mapei.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- C. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
  - 1. Products:
    - a. ARDEX Engineered Cements; ARDEX X 3 Plus: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
    - b. LATICRETE International, Inc; 253R Gold Rapid: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
    - c. Mapei Corporation; Keraflex Plus: [www.mapei.com/#sle](http://www.mapei.com/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
- D. Mortar Bed Materials:
  - 1. Pre-packaged mix of Portland cement, sand, latex additive, and water.
    - a. Products:
      - 1) ARDEX Engineered Cements; A 38: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
      - 2) LATICRETE International, Inc; LATICRETE 3701 Fortified Mortar Bed: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
      - 3) Mapei Corporation; 4 to 1 Mud Bed Mix: [www.mapei.com/#sle](http://www.mapei.com/#sle).
      - 4) Substitutions: See Section 01 6000 - Product Requirements.
  - 2. Mortar Bed Reinforcing: 2x2 inch mesh, 16/16 gauge wire, galvanized steel.

### **2.04 GROUTS**

- A. Provide setting and grout materials from same manufacturer.
- B. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
  - 1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
  - 2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
  - 3. Color(s): As selected by Architect from manufacturer's full line.
  - 4. Products:
    - a. ARDEX Engineered Cements; ARDEX FL: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
    - b. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
    - c. Mapei Corporation; Ultracolor Plus FA: [www.mapei.com/#sle](http://www.mapei.com/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.

## **2.05 MAINTENANCE MATERIALS**

- A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
  - 1. Applications: Between tile flooring and wall base, and at inside corners on walls.
  - 2. Color(s): As selected by Architect from manufacturer's full line.
  - 3. Products:
    - a. ARDEX Engineered Cements; ARDEX SX: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
    - b. LATICRETE International, Inc; LATICRETE LATASIL: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
    - c. Mapei Corporation; Mapesil T Plus: [www.mapei.com/#sle](http://www.mapei.com/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.

## **2.06 ACCESSORY MATERIALS**

- A. Cleavage Membrane Under Thick Mortar Bed:
  - 1. Material: 4 mil thick polyethylene film.
- B. Backer Board: See Section 09 2116.
- C. Mesh Tape: 2 inch wide self-adhesive fiberglass mesh tape.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.
- D. Verify that required floor-mounted utilities are in correct location.

### **3.02 PREPARATION**

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

### **3.03 INSTALLATION - GENERAL**

- A. Install tile and thresholds and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.20, manufacturer's instructions, and TCNA (HB) or TCNA (HB-GP) recommendations, as applicable.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles square with non-ceramic trim.
- F. Install non-ceramic trim in accordance with manufacturer's instructions.
- G. Install thresholds where indicated.
- H. Sound tile after setting. Replace hollow sounding units.
- I. Keep control and expansion joints free of mortar, grout, and adhesive.

- J. Prior to grouting, allow installation to completely cure; follow mortar manufacturer's written recommendation for minimum cure time.
- K. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- L. At changes in plane and tile-to-tile control joints (For example: Inside corners and where wainscot meets the floor) use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

#### **3.04 INSTALLATION - FLOORS - MORTAR BED METHODS**

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F111, with cleavage membrane, unless otherwise indicated.
- B. Cleavage Membrane: Lap edges and ends.
- C. Mortar Bed Thickness: As indicated on drawings.

#### **3.05 INSTALLATION - WALL TILE**

- A. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

#### **3.06 CLEANING**

- A. Clean tile and grout surfaces.

#### **3.07 PROTECTION**

- A. Do not permit traffic over finished floor surface for 24 hours after installation. Protect wall installations from impact, vibration, and hammering on adjacent or opposite walls for 14 days after tile installation.

**END OF SECTION 09 3000**

## **SECTION 09 5100 ACOUSTICAL CEILINGS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Suspended metal grid ceiling system.
- B. Acoustical units.
- C. Accessories and metal edge trim.

#### **1.02 REFERENCE STANDARDS**

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- B. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.
- C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019 (Reapproved 2025).
- D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

#### **1.03 ADMINISTRATIVE REQUIREMENTS**

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on suspension system components, acoustical units, and accessories.
- C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

#### **1.05 FIELD CONDITIONS**

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 55 percent prior to, during, and after acoustical unit installation.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Acoustic Tiles/Panels:
  - 1. Armstrong World Industries, Inc; Ultima High NRC 2081: [www.armstrongceilings.com/#sle](http://www.armstrongceilings.com/#sle).
  - 2. Certainteed Architectural; Symphony m High NRC 1222BB-85-1: [www.certainteed.com/ceilings-and-walls/#sle](http://www.certainteed.com/ceilings-and-walls/#sle).
  - 3. USG Corporation; Mars High-NRC 88135: [www.usg.com/ceilings/#sle](http://www.usg.com/ceilings/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Suspension Systems:
  - 1. Same as for acoustical units.

#### **2.02 ACOUSTICAL UNITS**

- A. Acoustical Units - General: ASTM E1264, Class A.
- B. Acoustical Panels: Mineral fiber with membrane-faced overlay, with the following characteristics:
  - 1. Classification: ASTM E1264 Type A

2. Size: 24 by 24 inches.
3. Thickness: 7/8 inch to 1 inch.
4. Light Reflectance: 0.85 minimum percent, determined in accordance with ASTM E1264.
5. NRC: 0.85, determined in accordance with ASTM E1264.
6. Panel Edge: Reveal.
7. Tile Edge: Beveled.
  - a. Joint: Kerfed and rabbeted.
8. Color:<>.
  - a. White, unless noted otherwise.
  - b. For 1200 square feet, allow for up to four colors selected from manufacturer's full range.
9. Suspension System: Exposed grid.

### **2.03 SUSPENSION SYSTEM(S)**

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
  1. Materials:
    - a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
- B. Exposed Suspension System: Hot-dip galvanized steel grid and cap.
  1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
  2. Profile: Tee; 15/16 inch face width.
  3. Color: <>.
    - a. White, unless noted otherwise.
    - b. For 1200 square feet, allow for up to four colors selected from manufacturer's full range.
  4. Products:
    - a. Armstrong World Industries, Inc; PRELUDE XL 15/16 inch: [www.armstrongceilings.com/#sle](http://www.armstrongceilings.com/#sle).
    - b. Certainteed Architectural; 15/16 EZ Stab Classic System: [www.certainteed.com](http://www.certainteed.com).
    - c. USG Corporation; Donn Brand DX 15/16 inch: [www.usg.com/ceilings/#sle](http://www.usg.com/ceilings/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.

### **2.04 ACCESSORIES**

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.
- C. Perimeter Moldings: Same metal and finish as grid.
- D. Metal Edge Trim for Suspension Systems: Steel or extruded aluminum; provide attachment clips, splice plates, and preformed corner pieces for complete trim system.
  1. Trim Height: 6 inches and 12 inches, as indicated on drawings.
  2. Finish: Baked enamel.
  3. Color: Allow for up to three colors, selected from manufacturer's full range..
  4. Products:
    - a. Armstrong World Industries, Inc; AXIOM Classic Curved: [www.armstrongceilings.com/#sle](http://www.armstrongceilings.com/#sle).
    - b. Certainteed Architectural; Terminus Perimeter Trim: [www.certainteed.com](http://www.certainteed.com).
    - c. USG Corporation; Compasso Suspension Trim: [www.usg.com/ceilings/#sle](http://www.usg.com/ceilings/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
- E. Touch-up Paint: Type and color to match acoustical and grid units.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

### **3.02 PREPARATION**

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.

### **3.03 INSTALLATION - SUSPENSION SYSTEM**

- A. Install suspension system in accordance with ASTM C636/C636M and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Locate system on room axis according to reflected plan.
- D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
  - 1. Use longest practical lengths.
- E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.

### **3.04 INSTALLATION - ACOUSTICAL UNITS**

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
  - 1. Cut to fit irregular grid and perimeter edge trim.
  - 2. Make field cut edges of same profile as factory edges.
  - 3. Double cut and field paint exposed reveal edges.
- F. Where round obstructions occur, provide preformed closures to match perimeter molding.
- G. Install hold-down clips on panels within 20 ft of an exterior door.

### **3.05 TOLERANCES**

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

### **3.06 CLEANING**

- A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.
- B. Clean surfaces.

- C. Replace damaged or abraded components.

**END OF SECTION 09 5100**

**SECTION 09 6500  
RESILIENT FLOORING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Resilient tile flooring.
- B. Resilient base.
- C. Installation accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 09 0561 - Common Work Results for Flooring Preparation: Cleaning, and preparation.
- B. Section 09 0561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.
- C. Section 09 6813 - Tile Carpeting: Additional requirements related to resilient subfloor leveling systems.

**1.03 REFERENCE STANDARDS**

- A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2023.
- B. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile; 2020.
- C. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- D. Verification Samples: Submit two full size samples of each selected color and pattern for each resilient flooring product specified.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Flooring Material: 50 square feet of each type and color.
  - 3. Extra Wall Base: 50 linear feet of each type and color.

**1.05 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- D. Do not double stack pallets.

**1.07 FIELD CONDITIONS**

**PART 2 PRODUCTS**

**2.01 TILE FLOORING**

- A. Vinyl Tile - Type LVT: Printed film type, with transparent or translucent wear layer.
  - 1. Manufacturers:

- a. J+J Flooring LLC; Step By Step: [www.jjflooringgroup.com](http://www.jjflooringgroup.com).
  - b. Mannington Commercial; Mixed Monolith Collection: [www.manningtoncommercial.com#sle](http://www.manningtoncommercial.com#sle).
  - c. Milliken & Company; Lumenology: [www.milliken.com](http://www.milliken.com).
  - d. Patcraft; Subtractive Layers: [www.patcraft.com](http://www.patcraft.com).
  - e. Shaw Contract; Colorlink 5.0: [www.shawcontractc.com](http://www.shawcontractc.com).
  - f. Substitutions: See Section 01 6000 - Product Requirements.
2. Minimum Requirements:
    - a. Comply with ASTM F1700, Class III, Type B.
  3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter (Class I) when tested in accordance with ASTM E648.
  4. Wear Layer Thickness: 0.020 inch, nominal.
  5. Total Thickness: 0.20 inch (5 mm) nominal.
  6. Color and Pattern: To be selected by Architect from manufacturer's full range of colors and patterns. Allow up to four colors/patterns, and installation in a multi-color/pattern layout.

## **2.02 RESILIENT BASE**

- A. Resilient Base: ASTM F1861, Type TP, rubber, thermoplastic; style as scheduled.
  1. Manufacturers:
    - a. Flexco Corporation; Base Sculptures: [www.flexcofloors.com/#sle](http://www.flexcofloors.com/#sle).
    - b. Mannington Commercial; Edge Effects: [www.manningtoncommercial.com#sle](http://www.manningtoncommercial.com#sle).
    - c. Roppe Corporation; Contours Profiled Wall Base System: [www.roppe.com/#sle](http://www.roppe.com/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
  2. Minimum Requirements: ASTM E84, Class B.
  3. Height: 4 inches nominal, architect to select from manufacturer's full line of profiles.
  4. Thickness: 0.375 inch nominal, architect to select from manufacturer's full line of profiles.
  5. Finish: Satin.
  6. Length: 8 foot sections.
  7. Color: To be selected by Architect from manufacturer's full range.

## **2.03 ACCESSORIES**

- A. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer. Provide full-spread, releasable adhesive for LVT.
- B. Moldings, Transition and Edge Strips: Vinyl.
  1. Manufacturers:
    - a. Flexco Corporation: [www.flexcofloors.com/#sle](http://www.flexcofloors.com/#sle).
    - b. Mannington Commercial: [www.manningtoncommercial.com#sle](http://www.manningtoncommercial.com#sle).
    - c. Roppe Corporation: [www.roppe.com/#sle](http://www.roppe.com/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
- C. Subfloor Leveling Systems: Vinyl.
  1. Manufacturers:
    - a. Flexco Corporation; Subleveling Systems: [www.flexcofloors.com/#sle](http://www.flexcofloors.com/#sle).
    - b. Mannington Commercial; The Equalizer - Subfloor Transition Systems: [www.manningtoncommercial.com#sle](http://www.manningtoncommercial.com#sle).
    - c. Roppe Corporation; Subleveler: [www.roppe.com/#sle](http://www.roppe.com/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
  - 1. Test in accordance with Section 09 0561.
  - 2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
  - 3. Follow moisture and alkalinity remediation procedures in Section 09 0561.
- D. Verify that required floor-mounted utilities are in correct location.

### **3.02 PREPARATION**

- A. Prepare floor substrates for installation of flooring in accordance with Section 09 0561.

### **3.03 INSTALLATION - GENERAL**

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Adhesive-Applied Installation:
  - 1. Spread only enough adhesive to permit installation of materials before initial set.
  - 2. Fit joints and butt seams tightly.
  - 3. Set flooring in place, press with heavy roller to attain full adhesion.
- D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- E. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- F. Install flooring in recessed floor access covers, maintaining floor pattern.

### **3.04 INSTALLATION - TILE FLOORING**

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Install flooring per the pattern indicated on the drawings, and per the approved shop drawings.

### **3.05 INSTALLATION - RESILIENT BASE**

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
- B. Miter internal corners. At external corners, "V" cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

### **3.06 INSTALLATION - SUBFLOOR LEVELING SYSTEMS**

- A. Verify length and thickness of subfloor leveling system required to provide level walking surfaces across flooring transitions, thresholds, and sliding door floor tracks.

### **3.07 CLEANING**

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

### **3.08 PROTECTION**

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

### **3.09 SCHEDULE**

- A. See drawings for floor finish schedule and layouts.

**END OF SECTION 09 6500**

## **SECTION 09 6813 TILE CARPETING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Carpet tile, fully adhered.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.
- B. Section 09 0561 - Common Work Results for Flooring Preparation: Cleaning and preparation.
- C. Section 09 0561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.
- D. Section 09 6500 - Resilient Flooring: Edge strips and subfloor leveling systems.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016 (Reapproved 2021).
- B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2023.
- C. CRI 104 - Standard for Installation of Commercial Carpet; 2015.
- D. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Selection Samples: Submit samples illustrating manufacturer's full range of colors and pattern designs.
- D. Verification Samples: Submit two carpet tiles illustrating colors and pattern designs for each carpet color and pattern selected.
- E. Installer's Qualification Statement.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

#### **1.05 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience.

#### **1.06 FIELD CONDITIONS**

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Tile Carpeting:
  - 1. J+J Flooring, LLC: [www.jjflooring.com](http://www.jjflooring.com).
  - 2. Mannington Commercial: [www.manningtoncommercial.com#sle](http://www.manningtoncommercial.com#sle).
  - 3. Milliken & Company: [www.milliken.com/#sle](http://www.milliken.com/#sle).
  - 4. Patcraft & Shaw Industries Group, Inc.: [www.patcraft.com](http://www.patcraft.com).

5. Shaw Industries Group, Inc: [www.shawcontract.com](http://www.shawcontract.com).
6. Substitutions: See Section 01 6000 - Product Requirements.

B. Provide all carpet tile products from one manufacturer.

## 2.02 MATERIALS

A. Tile Carpeting, Type CPT-1:

1. Products:
  - a. J+J Flooring Group, LLC; Stria: [www.jjflooring.com](http://www.jjflooring.com).
  - b. Mannington Commercial; Collection - Poetica, Pattern - Montgomery: [www.manningtoncommercial.com](http://www.manningtoncommercial.com).
  - c. Milliken & Company; Collection - Consequence 2.0, Pattern - Effect: [www.milliken.com](http://www.milliken.com).
  - d. Patcraft & Shaw Industries Group, Inc.; Collection - States of Water, Pattern - Tidal: [www.patcraft.com](http://www.patcraft.com).
  - e. Shaw Industries Group, Inc; Collection - Altered, Pattern - Distort: [www.shawcontract.com](http://www.shawcontract.com).
  - f. Substitutions: See Section 01 6000 - Product Requirements.
2. Color: Architect to select from manufacturer's full range, allow up to four colors.
3. Critical Radiant Flux: Minimum of 0.45 watts/sq cm (Class I) when tested in accordance with ASTM E648 or NFPA 253.
4. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
5. Pile Weight: Minimum 18 oz/sq yd.
6. Backing: Cushioned.

B. Tile Carpeting, Type CPT-2:

1. Products:
  - a. J+J Flooring Group, LLC; Naturalist Modular: [www.jjflooring.com](http://www.jjflooring.com).
  - b. Mannington Commercial; Collection - TxStyle, Pattern - Bark II: [www.manningtoncommercial.com](http://www.manningtoncommercial.com).
  - c. Milliken & Company; Collection - Consequence 2.0, Pattern - Sequel: [www.milliken.com](http://www.milliken.com).
  - d. Patcraft & Shaw Industries Group, Inc.; Collection - Isle of Syke, Pattern - Inverness: [www.patcraft.com](http://www.patcraft.com).
  - e. Shaw Industries Group, Inc; Collection - Hand Drawn, Pattern - Fine Point Tile: [www.shawcontract.com](http://www.shawcontract.com).
  - f. Substitutions: See Section 01 6000 - Product Requirements.
2. Color: Architect to select from manufacturer's full range, allow up to four colors.
3. Critical Radiant Flux: Minimum of 0.45 watts/sq cm (Class I) when tested in accordance with ASTM E648 or NFPA 253.
4. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
5. Pile Weight: Minimum 19 oz/sq yd.
6. Backing: Cushioned

C. Tile Carpeting, Type CPT-3:

1. Products:
  - a. J+J Flooring Group, LLC; Skyline: [www.jjflooring.com](http://www.jjflooring.com).
  - b. Mannington Commercial; Collection - The Hocus, Pattern - Observer: [www.manningtoncommercial.com](http://www.manningtoncommercial.com).
  - c. Milliken & Company; Collection - Consequence 2.0, Pattern - Upshot: [www.milliken.com](http://www.milliken.com).
  - d. Patcraft & Shaw Industries Group, Inc.; Collection - Tangible Hue, Pattern - Achieve: [www.patcraft.com](http://www.patcraft.com).
  - e. Shaw Industries Group, Inc; Collection - Cut And Compose, Pattern - Copy Tile: [www.shawcontract.com](http://www.shawcontract.com).
  - f. Substitutions: See Section 01 6000 - Product Requirements.

2. Color: Architect to select from manufacturer's full range, allow up to four colors.
  3. Critical Radiant Flux: Minimum of 0.45 watts/sq cm (Class I) when tested in accordance with ASTM E648 or NFPA 253.
  4. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
  5. Pile Weight: Minimum 16 oz/sq yd.
  6. Backing: Cushioned.
- D. Tile Carpeting, Type ETC: Entryway Tile Carpet
1. Products:
    - a. J+J Flooring Group, LLC; Incognito: [www.jjf flooring.com](http://www.jjf flooring.com).
    - b. Mannington Commercial; Friktion Entryway Systems, Force Modular: [www.manningtoncommercial.com](http://www.manningtoncommercial.com).
    - c. Milliken & Company; Obex Loop Stack: [www.milliken.com](http://www.milliken.com).
    - d. Patcraft & Shaw Industries Group, Inc.; Entry Esthetic: [www.patcraft.com](http://www.patcraft.com).
    - e. Shaw Industries Group, Inc; All Access, Path: [www.shawcontract.com](http://www.shawcontract.com).
    - f. Substitutions: See Section 01 6000 - Product Requirements.
  2. Color: Architect to select from manufacturer's full range, allow up to two colors.
  3. Critical Radiant Flux: Minimum of 0.45 watts/sq cm (Class I) when tested in accordance with ASTM E648 or NFPA 253.
  4. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
  5. Gauge: 1/12 inch.
  6. Construction: Textured or multi-level pattern loop.
  7. Pile Weight: Minimum 26 oz/sq yd.

## **2.03 ACCESSORIES**

- A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.
- B. Subfloor Leveling Systems: See Section 09 6500.
- C. Edge Strips: See Section 09 6500.
- D. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.
- C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
  1. Test in accordance with Section 09 0561.
  2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
- E. Verify that required floor-mounted utilities are in correct location.

### **3.02 PREPARATION**

- A. Prepare floor substrates for installation of flooring in accordance with Section 09 0561.

### **3.03 INSTALLATION**

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Provide subfloor leveling system to set top of carpet tiles flush with transitions, sliding door floor tracks, and thresholds.
- C. Install carpet tile in accordance with manufacturer's instructions and CRI 104 (Commercial).

- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. See drawings for extents of each carpet type.
- F. Lay carpet tile in ashlar pattern, with pile direction parallel to next unit, set parallel to building lines.
- G. Where multiple colors are selected for an area, lay in pattern indicated by Architect.
- H. Locate change of color or pattern between rooms under door centerline, or as directed by Architect.
- I. Fully adhere carpet tile to substrate.
- J. Trim carpet tile neatly at walls and around interruptions.
- K. Complete installation of edge strips, concealing exposed edges.

#### **3.04 CLEANING**

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- B. Clean and vacuum carpet surfaces.

**END OF SECTION 09 6813**

**SECTION 09 8430  
SOUND-ABSORBING WALL AND CEILING UNITS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Sound-absorbing panels for walls and ceilings.
- B. Mounting accessories.

**1.02 RELATED REQUIREMENTS**

- A. Division 26 - Electrical: Suspended sound-absorbing lighting fixtures and coordinating suspended sound-absorbing unlit baffles.

**1.03 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's printed data sheets for products specified, including fabrication and installation details.
- C. Selection Samples: Manufacturer's color charts for fabric covering, indicating full range of fabrics, colors, and patterns available.
- D. Verification Samples:
  - 1. Fabricated samples of each type of panel specified; 12 by 12 inch, showing construction, edge details, and fabric covering.
  - 2. Samples of selected fabric patterns and colors; 12 by 12 inch minimum.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with at least three years of documented experience.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.
- B. Store units flat, in dry, well-ventilated space; do not stand on end.
- C. Protect edges from damage.

**PART 2 PRODUCTS**

**2.01 FABRIC-COVERED SOUND-ABSORBING UNITS**

- A. Manufacturers:
  - 1. Acoustical Solutions; Alphasorb: [www.acousticalsolutions.com](http://www.acousticalsolutions.com).
  - 2. ATS Acoustics; Acoustic Panels: [Atsacoustics.com](http://Atsacoustics.com).
  - 3. G&S Acoustics; Acousti-Panels AP: [www.gsacoustics.com](http://www.gsacoustics.com).
  - 4. LAMVIN; SONIC PANEL: [www.lamvin.com/#sle](http://www.lamvin.com/#sle).
  - 5. Sound Acoustic Solutions; SilentScape: [www.soundacousticsolutions.com](http://www.soundacousticsolutions.com).
  - 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. General:
  - 1. Prefinished, factory assembled fabric-covered panels.
  - 2. Surface Burning Characteristics: Class A, Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
- C. Fabric-Covered Acoustical Panels for Walls and Ceilings:
  - 1. Panel Core: Manufacturer's standard rigid or semi-rigid fiberglass core.
  - 2. Panel Size: <>.

- a. Ceilings: 4 feet wide by custom length as noted on drawings - field verify.
- b. Walls: 18 high by 24 inches wide, 36 high by 24 inches wide, and 18 high by 48 inches wide, installed in pattern shown on drawings.
- 3. Panel Thickness: 2 inches.
- 4. Edges: Perimeter edges reinforced by a formulated resin hardener.
- 5. Corners: Mitered.
- 6. Fabric: Woven polyester. Anchorage by Guilford of Maine, or similar by another manufacturer.
- 7. Color: As selected by Architect from manufacturer's full range. Allow for four colors.
- 8. Mounting Method:
  - a. Walls: Impaling clips, concealed.
  - b. Ceilings: Spline-mounted, concealed.

## **2.02 SUSPENDED SOUND-ABSORBING LIGHT FIXTURES AND COORDINATING UNLIT BAFFLES**

- A. Suspended sound-absorbing light fixtures and coordinating unlit baffles to be furnished and installed by electrician - See electrical drawings.

## **2.03 FABRICATION**

- A. Fabric Wrapped, General: Fabricate panels to sizes and configurations as indicated, with fabric facing installed without sagging, wrinkles, blisters, or visible seams.
  - 1. Where radiused or mitered corners are indicated, install fabric to avoid seams or gathering of material.
- B. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch for thickness, overall length and width, and squareness from corner to corner.

## **2.04 ACCESSORIES**

- A. Spline-Mounting Accessories: Manufacturer's standard concealed connecting splines of extruded aluminum designed for screw attachment to walls and ceilings.

# **PART 3 EXECUTION**

## **3.01 EXAMINATION**

- A. Examine substrates for conditions detrimental to installation of acoustical units. Proceed with installation only after unsatisfactory conditions have been corrected.

## **3.02 INSTALLATION**

- A. Install acoustical units in locations as indicated, following manufacturer's installation instructions.
- B. Install mounting accessories and supports in accordance with manufacturer's recommendations for project conditions.
- C. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.
- D. Install acoustical units to construction tolerances of plus or minus 1/16 inch for the following:
  - 1. Plumb and level.
  - 2. Flatness.
  - 3. Width of joints.

## **3.03 CLEANING**

- A. Clean sound-absorptive panels upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

## **3.04 PROTECTION**

- A. Provide protection of installed acoustical panels until Date of Substantial Completion.
- B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

**END OF SECTION 09 8430**

## **SECTION 09 9113 EXTERIOR PAINTING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Non-galvanized steel, including structural steel posts at monument sign<> .

#### **1.02 REFERENCE STANDARDS**

- A. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- B. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

#### **1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
  - 2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

#### **1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

#### **1.05 FIELD CONDITIONS**

- A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
  - 1. Behr Paint Company: [www.behr.com/#sle](http://www.behr.com/#sle).
  - 2. Pittsburgh Paints: [www.pittsburghpaintsco.com/#sle](http://www.pittsburghpaintsco.com/#sle).
  - 3. Sherwin-Williams Company: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).

#### **2.02 PAINTS AND FINISHES - GENERAL**

- A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
  - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.

2. Supply each paint material in quantity required to complete entire project's work from a single production run.
  3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.
- B. Colors: To be selected from manufacturer's full range of available colors.
1. Selection to be made by Architect after award of contract.

### **2.03 PAINT SYSTEMS - EXTERIOR**

- A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including primed metal.
1. Two top coats and one coat primer.
  2. Top Coat(s): Exterior Light Industrial Coating, Water Based.
    - a. Products:
      - 1) Behr Premium Interior/Exterior Direct-To-Metal Paint Eggshell [No.7200].
      - 2) Pittsburgh Paints Pitt-Tech Plus EP DTM Industrial Enamel, 90-1710 Series, Satin.
      - 3) Sherwin-Williams Pro Industrial DTM Acrylic, Eg-Shel.
      - 4) Substitutions: See Section 01 6000 - Product Requirements
  3. Primer: As recommended by top coat manufacturer for specific substrate.

### **2.04 ACCESSORY MATERIALS**

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Ferrous Metal:
  1. Solvent clean according to SSPC-SP 1.
  2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
  3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3. Protect from corrosion until coated.

### **3.03 APPLICATION**

- A. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- B. Apply each coat to uniform appearance.

**END OF SECTION 09 9113**

**SECTION 09 9123  
INTERIOR PAINTING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
  - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
  - 2. Plumbing, Mechanical, Electrical, and Fire Protection:
    - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, and hangers, brackets, collars and supports, unless otherwise indicated.
    - b. In finished areas, paint shop-primed items.
    - c. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
    - d. Paint dampers exposed behind louvers, grilles, to match face panels.
- D. Do Not Paint or Finish the Following Items:
  - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
  - 5. Stainless steel and anodized aluminum items.
  - 6. Floors, unless specifically indicated.
  - 7. Ceramic and other tiles.
  - 8. Glass.
  - 9. Acoustical materials, unless specifically indicated.
  - 10. Concealed pipes, ducts, and conduits.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Staining of wood roof deck and glue laminated wood structure.
- B. Section 07 0553 - Fire and Smoke Assembly Identification.
- C. Section 09 9300 - Staining and Transparent Finishing.

**1.03 REFERENCE STANDARDS**

- A. SSPC V1 (PM1) - Good Painting Practice: Painting Manual Volume 1; 2024.
- B. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- C. SSPC-SP 2 - Hand Tool Cleaning; 2024.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
  - 2. Cross-reference to specified paint system products to be used in project; include description of each system.

3. Manufacturer's product data sheet.
- C. Selection Samples: Submit manufacturer's full range of paint chip samples for color selection
- D. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, and repair of painted and finished surfaces.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. See Section 01 6000 - Product Requirements, for additional provisions.
  2. Extra Paint and Finish Materials: 1 gal of each color, type, and surface texture; from the same product run, store where directed.
  3. Label each container with color in addition to the manufacturer's label.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

#### **1.06 FIELD CONDITIONS**

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 fc measured mid-height at substrate surface.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
  1. Behr Paint Company: [www.behr.com/#sle](http://www.behr.com/#sle).
  2. Pittsburgh Paints: [www.ppgpaints.com/#sle](http://www.ppgpaints.com/#sle).
  3. Sherwin-Williams Company: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
- C. Primer Sealers: Same manufacturer as top coats.
- D. Substitutions: See Section 01 6000 - Product Requirements.

#### **2.02 PAINTS AND FINISHES - GENERAL**

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
  1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
  2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

3. Supply each paint material in quantity required to complete entire project's work from a single production run.
  4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- C. Colors: To be selected from manufacturer's full range of available colors.
1. Selection to be made by Architect after award of contract.
  2. Allow for minimum of six colors for each system, unless otherwise indicated, without additional cost to Owner.
  3. Extend colors to surface edges; colors may change at any edge as directed by Architect.

## **2.03 PAINT SYSTEMS - INTERIOR**

- A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, uncoated steel, shop primed steel, and galvanized steel.
1. Two top coats and one coat primer.
  2. Top Coat(s): High Performance Architectural Interior Latex.
    - a. Products:
      - 1) Behr Dynasty Interior Eggshell Enamel [No.2650].
      - 2) Pittsburgh Paints Pure Performance Interior Latex, 9-310XI Series, Eggshell.
      - 3) Sherwin-Williams ProMar 200 HP Series, Eg-Shel.
      - 4) Substitutions: See Section 01 6000 - Product Requirements
  3. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Paint I-OP-MD-WC - Medium Duty Vertical: Including gypsum board.
1. Two top coats and one coat primer.
  2. Top Coat(s): Interior Light Industrial Coating, Water Based.
    - a. Products:
      - 1) Behr Pro Pre-Catalyzed Waterborne Epoxy Eggshell [HP140].
      - 2) Pittsburgh Paints Pitt-Glaze WB1 High Performance Pre-Catalyzed Waterborne Epoxy, 16-1310 Series, Eggshell.
      - 3) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Eg-Shel.
      - 4) Substitutions: See Section 01 6000 - Product Requirements

## **2.04 ACCESSORY MATERIALS**

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin application of paints and finishes until substrates have been adequately prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.
- F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
  1. Gypsum Wallboard: 12 percent.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- F. Galvanized Surfaces:
  - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
  - 2. Prepare surface according to SSPC-SP 2.
- G. Ferrous Metal:
  - 1. Solvent clean according to SSPC-SP 1.
  - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
  - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer<>. Protect from corrosion until coated.

### **3.03 APPLICATION**

- A. Apply products in accordance with manufacturer's written instructions.
- B. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- E. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
- F. Sand metal surfaces lightly between coats to achieve required finish.
- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- H. Wood to Receive Transparent Finishes: See Section 09 9300.
- I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

### **3.04 PROTECTION**

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

### **3.05 SCHEDULE - PAINT SYSTEMS**

- A. Gypsum Board: Finish surfaces exposed to view, except where finish schedule on drawings indicates "Epoxy Painted".
  - 1. Interior Walls, Ceilings and Bulkheads: I-OP.
- B. Gypsum Board: Finished surfaces exposed to view, where finish schedule on drawings indicates "Epoxy Painted".
  - 1. Interior Walls, Ceilings, and Bulkheads: I-OP-MD-WC.
- C. Ducts, Conduits, and Pipes: Finish surfaces exposed to view: I-OP.

**END OF SECTION 09 9123**

**SECTION 09 9300  
STAINING AND TRANSPARENT FINISHING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Field application of stains.
- B. Field application of transparent finishes.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Stains and transparent finishes for wood roof deck and glue laminated wood structure.

**1.03 DEFINITIONS**

- A. Comply with ASTM D16 for interpretation of terms used in this section.

**1.04 REFERENCE STANDARDS**

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.
- B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and catalog number, and general product category.
  - 2. Manufacturer's installation instructions.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements for additional provisions.
  - 2. Extra Stock Materials: Stain and transparent finish materials, 1 gal of each color and type; store where directed.
    - a. Label each container with type and texture in addition to the manufacturer's label.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of stain or transparent finish, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Stain and Transparent Finish Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

**1.07 FIELD CONDITIONS**

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by manufacturer of stains and transparent finishes.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.
- D. Minimum Application Temperature: 50 degrees F unless required otherwise by manufacturer's instructions.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Transparent Finishes:
  - 1. Behr Process Corporation: [www.behr.com/#sle](http://www.behr.com/#sle).
  - 2. Pittsburgh Paints: [www.ppgpaints.com/#sle](http://www.ppgpaints.com/#sle).
  - 3. Sherwin-Williams Company: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

### **2.02 STAINS AND TRANSPARENT FINISHES - GENERAL**

- A. Finishes:
  - 1. Provide finishes capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
  - 2. Provide materials compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
  - 3. Supply each finish material in quantity required to complete entire project's work from a single production run.
  - 4. Do not reduce, thin, or dilute finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

### **2.03 INTERIOR STAIN AND TRANSPARENT FINISH SYSTEMS**

- A. Finish on Wood - Vertical Surfaces:
  - 1. Top Coat: Clear water-based varnish.
    - a. Products:
      - 1) Behr Fast Drying Water-Based Polyurethane [B8100].
      - 2) Pittsburgh Paints; Proluxe Interior/Exterior Clear Water-Based Polyurethane: [www.ppgpaints.com](http://www.ppgpaints.com).
      - 3) Sherwin-Williams; Minwax Polycrylic: [www.sherwin-williams.com](http://www.sherwin-williams.com).
      - 4) Substitutions: Section 01 6000 - Product Requirements.
  - 2. Top Coat Sheen:
    - a. Flat: MPI gloss level 1; use this sheen at all locations.

### **2.04 ACCESSORY MATERIALS**

- A. Accessory Materials: Cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of finished surfaces.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin application of finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

- C. Remove surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing.

### **3.03 APPLICATION**

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply a minimum of three coats. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- D. Sand wood surfaces lightly between coats to achieve required finish.
- E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- F. Reinstall items removed prior to finishing.

### **3.04 CLEANING**

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

### **3.05 PROTECTION**

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

**END OF SECTION 09 9300**

## **SECTION 10 1100 VISUAL DISPLAY UNITS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Porcelain enamel steel markerboards and accessories.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Blocking and supports.

#### **1.03 REFERENCE STANDARDS**

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data on porcelain enamel steel markerboard, trim, and accessories.
- C. Sample Warranty.

#### **1.05 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

### **PART 2 PRODUCTS**

#### **2.01 VISUAL DISPLAY UNITS**

- A. Porcelain Enamel Steel Markerboards:
  - 1. Manufacturers:
    - a. ASI Visual Display Products; Series 9100 Marker with Eraser Caddy: [www.asi-visualdisplayproducts.com/#sle](http://www.asi-visualdisplayproducts.com/#sle).
    - b. Claridge Products and Equipment, Inc; Arise Series with Slim Marker Caddy: [www.claridgeproducts.com/#sle](http://www.claridgeproducts.com/#sle).
    - c. MooreCo Inc.; Ultra-Trim with Magnetic Q-Tray: [www.moorecoinc.com](http://www.moorecoinc.com).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
  - 2. Color: White.
  - 3. Steel Face Sheet Thickness: 28 gauge, 0.0149 inch minimum.
  - 4. Core: Manufacturer's standard backer, <>, laminated to face sheet.
  - 5. Backing: Manufacturer's standard, laminated to core.
  - 6. Height: 48 inches.
  - 7. Length: 6 feet , in one piece.
  - 8. Frame: Extruded aluminum , with concealed fasteners.
  - 9. Frame Finish: Anodized, natural.
  - 10. Accessories: Provide Magnetic marker and eraser caddy.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on drawings.

#### **3.02 PREPARATION**

- A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

#### **3.03 INSTALLATION**

- A. Install boards in accordance with manufacturer's instructions.

- B. Install with bottom of perimeter frame at 30 inches above finished floor.
- C. Secure units level and plumb.
- D. Butt Joints: Install with tight hairline joints.
- E. Carefully cut holes in boards for thermostats and wall switches.

#### **3.04 CLEANING**

- A. Clean board surfaces in accordance with manufacturer's instructions.
- B. Cover with protective cover, taped to frame.
- C. Remove temporary protective cover at Date of Substantial Completion.

**END OF SECTION 10 1100**

## **SECTION 10 1416 PLAQUES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Plaques.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 10 1419 - Dimensional Letter Signage: Cut and formed metal logos and letters.
- B. Section 10 1423 - Panel Signage: Exterior and Interior panel signage.
- C. Section 10 1426 - Post and Panel Signage: Site navigation signage.
- D. Section 10 1433 - Illuminated Cabinet Signage: Illuminated signage at monument sign and building-mounted illuminated signage.

#### **1.03 REFERENCE STANDARDS**

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's product literature for each type of plaque sign, indicating style, font, foreground and background colors, locations, and overall dimensions of each sign.
- C. Shop Drawings: Indicate dimensions, locations, elevations, materials, text and graphic layout, and attachment details.
- D. Selection Samples: Where materials, colors, and finishes are not specified, submit one set of color selection charts or chips.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Package plaque signs as required to prevent damage before installation.
- B. Store under cover and elevated above grade.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Plaques:
  - 1. Gemini, Inc.: [www.geminimade.com](http://www.geminimade.com).
  - 2. Impact Signs, Inc.: [www.impactsigns.com](http://www.impactsigns.com).
  - 3. Matthews Bronze international: [www.matthewsid.com](http://www.matthewsid.com).
  - 4. The Southwell Company: [www.southwellco.com](http://www.southwellco.com).
  - 5. Substitutions: See Section 01 6000 - Product Requirements.

#### **2.02 REGULATORY REQUIREMENTS**

- A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

#### **2.03 PLAQUES**

- A. Metal Plaques:
  - 1. Material: Aluminum casting.
  - 2. Material Thickness: 1/4 inch, minimum.
  - 3. Size: 30 inches by 20 inches.
  - 4. Text and Typeface:

- a. Text: To be provided by Architect.
- b. Character Font: Helvetica, Arial, or other sans serif font.
- c. Character Case: Upper case only.
- d. Character Color: Aluminum color.
- 5. Border Style: Single line.
- 6. Background Texture: Stipple.
- 7. Surface Finish: Brushed, satin.
- 8. Painted Background Color: As selected by Architect from manufacturer's standard background colors.
- 9. Mounting: Blind studs.

#### **2.04 ACCESSORIES**

- A. Concealed Screws: Noncorroding metal; stainless steel, galvanized steel, or chrome plated.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify mounting location with Architect.
- B. Verify that substrate surfaces are ready to receive work.
- C. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

#### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install with horizontal edges level.
- C. Locate plaque signs and mount at heights where directed by Architect and in accordance with ADA Standards and ICC A117.1.
- D. Protect from damage until Final Completion, repair or replace damaged items.

**END OF SECTION 10 1416**

**SECTION 10 1419  
DIMENSIONAL LETTER SIGNAGE**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Dimensional letters.
- B. Dimensional logos.

**1.02 RELATED REQUIREMENTS**

- A. Section 10 1416 - Plaques: Cast metal plaques.
- B. Section 10 1423 - Panel Signage: Exterior and interior panel signage.
- C. Section 10 1426 - Post and Panel Signage: Site navigation signage.
- D. Section 10 1433 - Illuminated Cabinet Signage: Illuminated signage at monument sign and building-mounted illuminated signage.

**1.03 REFERENCE STANDARDS**

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's product literature for each type of dimensional letter sign, indicating style, font, colors, locations, and overall dimensions of each sign.
- C. Shop Drawings:
  - 1. Include dimensions, locations, elevations, materials, text and graphic layout, and attachment details.
- D. Selection Samples: Where materials, colors, and finishes are not specified, submit chips original hardcopy of color selection chart showing manufacturer's full range of colors.
- E. Verification Samples: Submit samples showing colors and finishes specified.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Package dimensional letter signs as required to prevent damage before installation.
- B. Store under cover and elevated above grade.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Dimensional Letter Signs and Logos:
  - 1. Gemini: [www.geminimade.com](http://www.geminimade.com).
  - 2. Impact Signs, Inc.: [www.impactsigns.com](http://www.impactsigns.com).
  - 3. Woodland Manufacturing, LLC: [www.woodlandmanufacturing.com](http://www.woodlandmanufacturing.com).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 REGULATORY REQUIREMENTS**

- A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

**2.03 DIMENSIONAL LETTERS**

- A. Applications:
  - 1. Monument Sign:

- a. Use metal logo consisting of custom graphic elements and individual metal letters.
  - b. Mounting Location: Exterior as indicated on drawings.
  - c. Graphics to be provided by Architect.
- 2. Building Identification:
  - a. Use individual metal letters.
  - b. Mounting Location: Exterior as indicated on drawings.
  - c. Allow for total of 38 letters, 18 inches high.
  - d. Allow for total of 5 letters, 12 inches high.
- 3. Interior Identification:
  - a. Use individual metal letters.
  - b. Mounting Location: Interior as indicated on drawings.
  - c. Allow for total of 42 letters, 12 inches high.
- B. Metal Logos:
  - 1. Material: Aluminum sheet, flat.
  - 2. Thickness: 1/2 inch minimum.
  - 3. Graphics and Text: Cut logo graphics and lettering to match vector artwork provided by Architect.
  - 4. Finish: Painted, colors As selected by Architect from manufacturer's full range. Allow for selection of up to 5 colors, including custom colors.
  - 5. Mounting: Concealed screws.
- C. Metal Letters, Exterior:
  - 1. Material: Aluminum sheet, flat.
  - 2. Thickness: 1/2 inch minimum.
  - 3. Text and Typeface:
    - a. Character Font: As selected by Architect from manufacturer's full range. Allow for match of Owner's standard font.
    - b. Character Case: Upper case only.
  - 4. Finish: Painted, color As selected by Architect from manufacturer's full range. Allow for selection of up to 5 colors, including custom colors.
  - 5. Mounting: Concealed screws.
- D. Metal Letters, Interior:
  - 1. Material: Aluminum sheet, fabricated reverse channel.
  - 2. Thickness: 2 inches.
  - 3. Text and Typeface:
    - a. Character Font: As selected by Architect from manufacturer's full range. Allow for match of Owner's standard font.
    - b. Character Case: Upper case only.
  - 4. Finish: Painted, color As selected by Architect from manufacturer's full range. Allow for selection of up to 3 colors, including custom colors.
  - 5. Mounting: Concealed screws.

## **2.04 ACCESSORIES**

- A. Concealed Screws: Noncorroding metal; stainless steel.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate surfaces are ready to receive work.
- B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.

- B. Install with horizontal edges level.
- C. Locate dimensional letter signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- D. Protect from damage until date of Substantial Completion; repair or replace damaged items.

**END OF SECTION 10 1419**

## **SECTION 10 1423 PANEL SIGNAGE**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Panel signage.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 10 1416 - Plaques: Cast metal plaques.
- B. Section 10 1419 - Dimensional Letter Signage: Cut and formed metal logos and letters.
- C. Section 10 1426 - Post and Panel Signage: Site navigation signage.
- D. Section 10 1433 - Illuminated Cabinet Signage: Illuminated signage at monument sign and building-mounted illuminated signage.

#### **1.03 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's product literature for each type of panel sign, indicating styles, font, foreground and background colors, locations, and overall dimensions of each sign.
- C. Shop Drawings:
  - 1. Include dimensions, locations, elevations, materials, text and graphic layout, attachment details, and schedules.
  - 2. Schedule: Provide information sufficient to completely define each panel sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
    - a. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
    - b. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
    - c. Submit for approval by Owner through Architect prior to fabrication.
- D. Samples: Submit one sample of each type of sign, of size similar to that required for project, indicating sign style, font, and method of attachment.
- E. Selection Samples: Where colors, materials, and finishes are not specified, submit color chips or original hardcopy of manufacturer's color selection chart.
- F. Verification Samples: Submit samples showing colors, materials, and finishes specified.
- G. Manufacturer's Installation Instructions: Include installation templates and attachment devices.
- H. Manufacturer's qualification statement.

#### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

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

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.
- C. Store under cover and elevated above grade.
- D. Store tape adhesive at normal room temperature.

## **1.07 FIELD CONDITIONS**

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain minimum ambient temperature during and after installation.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Panel Signage:
  - 1. Best Sign Systems, Inc; Graphic Blast MP with Bento Box Frames: [www.bestsigns.com/#sle](http://www.bestsigns.com/#sle).
  - 2. Mohawk Sign Systems, Inc; Series 200A MP with frames: [www.mohawksign.com/#sle](http://www.mohawksign.com/#sle).
  - 3. Navitor Specialty Products; ADA Photopolymer: [www.navitorsp.com](http://www.navitorsp.com).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

### **2.02 REGULATORY REQUIREMENTS**

- A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

### **2.03 PANEL SIGNAGE**

- A. Panel Signage:
  - 1. Application: Room and door signs.
  - 2. Description: Flat signs with engraved panel media, tactile characters.
  - 3. Sign Size: As indicated on drawings.
  - 4. Color and Font, unless otherwise indicated:
    - a. Character Font: Helvetica, Arial, or other sans serif font.
    - b. Character Case: Upper and lower case (title case).
    - c. Background Colors: 3 colors, as selected by Architect from manufacturer's full range.
    - d. Character Color: Contrasting color.
  - 5. Material: Laminated colored plastic engraved through face to expose core as background color.
  - 6. Profile: Sculpted flat panel without frame, shape as indicated on drawings.
  - 7. Tactile Letters: Raised 1/32 inch minimum.
  - 8. Braille: Grade II, ADA-compliant.
  - 9. One-Sided Wall Mounting: Tape adhesive.
  - 10. Glass Mounting: Tape adhesive, with matching backing panel.

### **2.04 SIGNAGE APPLICATIONS**

- A. Room and Door Signs:
  - 1. Office Doors: Identify with room names and numbers to be determined later, not those indicated on drawings; provide "window" section for replaceable occupant name.
  - 2. Conference and Meeting Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings; provide "window" section with sliding "In Use/Vacant" indicator.
  - 3. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
  - 4. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.
- B. Emergency Evacuation Map Panel Signs:
  - 1. Allow for one map.
- C. Recognition/Donor Panels:
  - 1. Dimensions and number of name signs: As indicated on drawings.
  - 2. Provide all name signs whether engraved or not, for uniform overall appearance.

## **2.05 ACCESSORIES**

- A. Backing Panel: Where signs are mounted on glass, provide adhesive-tape-mounted backing panel matching colors and profile of sign panel.
- B. Tape Adhesive: Double-sided tape, permanent adhesive.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate surfaces are ready to receive work.
- B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install with horizontal edges level.
- C. Locate panel signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- D. Protect from damage until date of Substantial Completion; repair or replace damaged items.

**END OF SECTION 10 1423**

**SECTION 10 1426  
POST AND PANEL SIGNAGE**

**PART 1 – GENERAL**

**1.01 SECTION INCLUDES**

- A. Post-mounted panel-type site directional signage.

**1.02 RELATED REQUIREMENTS**

- A. Civil Drawings: Concrete mix for sign post footings.
- B. Section 10 1416 - Plaques: Cast metal plaques.
- C. Section 10 1419 - Dimensional Letter Signage: Cut and formed metal logos and letters.
- D. Section 10 1423 - Panel Signage: Exterior and interior panel signage.
- E. Section 10 1433 - Illuminated Cabinet Signage: Illuminated signage at monument sign and building-mounted illuminated signage.

**1.03 REFERENCE STANDARDS**

- A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

**1.04 SUBMITTALS**

- A. General: Refer to Specifications Section 01 300 Administrative Requirements for submittal requirements and procedures.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings:
  - 1. Include fabrication and installation details for the following:
    - a. Layouts for each sign including panel sizes, text, and graphic elements.
    - b. Mounting heights, locations of supports and accessories.
- D. Selection Samples: Submit color chips or original hardcopy of color selection chart showing manufacturer's full range of colors and sheens.
- E. Verification Samples: Submit physical samples of each color and sheen selected.
- F. Qualifications: Refer to "Quality Assurance" Article.

**1.05 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with applicable provisions in Americans with Disabilities Act, ICC A117.1-2009, and North Carolina Building Building Code.
- B. Fabricator Qualifications:
  - 1. Minimum 5 years experience in fabrication of post and panel signage.
  - 2. Submit a project reference list and photos of public or commercial exterior projects currently using signage and information systems supplied by the manufacturer.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, and handle materials in accordance with Section 01 6000, Product Requirements and Manufacturer's instructions. Store in dry, secure location, protected against direct sunlight and excessive heat.

## **PART 2 – PRODUCTS**

### **2.01 POST AND PANEL SIGNS**

- A. Site Directional Signage, Post-Mounted:
  - 1. Posts: Extruded-aluminum posts with integral channel for attachment of sign frames, nominal 3 inch deep, rectangular.
    - a. Caps: Flush.
    - b. Filler: Flush filler to close portion of channel exposed below sign panel.
  - 2. Sign Panel Frames: Aluminum extrusions with concealed anchors, with square edges and corners, depth to match thickness of posts.
  - 3. Sign Panels: Aluminum with concealed connection to posts, rectangular, with custom artwork. Face panels 1/8 inch thick, minimum.
  - 4. Finishes:
    - a. Posts: Painted; color selected by Architect from manufacturer's full range.
    - b. Sign Frames and Panels: Painted; color and sheen selected by Architect from manufacturer's full range. With custom artwork.
  - 5. Artwork: The Contractor shall furnish a graphic layout showing the required logos, fonts, and layout of sign for use by the Contractor. The Contractor shall develop and complete final artwork for fabrication of each sign panel based on text and graphics provided by Architect. Allow for custom text, logos and graphics using multiple colors.
    - a. Artwork Materials: Manufacturer's option of paint or applied vinyl.
  - 6. Products:
    - a. Charleston Sign Manufacturing; Series 325: [www.charlestonesignmanufacturing.com](http://www.charlestonesignmanufacturing.com).
    - b. Howard Industries; HED-300: [www.howardindustries.com](http://www.howardindustries.com).
    - c. SignComp; Series 3: [www.signcomp.com](http://www.signcomp.com).
    - d. Substitutions: See Section 01 6000 - Product Requirements

### **2.02 MATERIALS**

- A. Aluminum Sheet and Plate: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 5005-H32.
- B. Aluminum Extrusions: ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 6063-T5.

### **2.03 ACCESSORIES**

- A. Fasteners: Provide stainless steel fasteners.

### **2.04 FABRICATION**

- A. General: Provide signs of configurations indicated.
  - 1. Mill joints to tight, hairline fit.
  - 2. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.
  - 3. Each sign face shall be fabricated from a single sheet of aluminum.
- B. Shop assemble units and apply finishes and graphics in accordance with the Contract Drawings, manufacturer's standards, and approved Shop Drawings.

## **PART 3 – EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that utilities have been located prior to digging footings. Notify Architect if existing utilities or other existing conditions are in conflict with indicated footing and signage locations.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly prior to installation.
- B. Protect surrounding work from damage by work of this Section.

### **3.03 INSTALLATION**

- A. Install signs and accessories where indicated, using methods complying with manufacturer's written instructions and approved Shop Drawings.
- B. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
- C. Temporarily brace signs until concrete footings have cured sufficiently to provide support, 3 days minimum.

### **3.04 CLEANING AND PROTECTION**

- A. Clean exposed surfaces in accordance with manufacturer's instructions.
- B. Protect from damage until date of Substantial Completion.

**END OF SECTION 10 1426**

**SECTION 10 1433  
ILLUMINATED CABINET SIGNAGE**

**PART 1 – GENERAL**

**1.01 SECTION INCLUDES**

- A. Exterior illuminated post-mounted and wall-mounted signs.

**1.02 RELATED REQUIREMENTS**

- A. Section 05 1200 - Structural Steel Framing and Structural Drawings: Coordination of attachment points on posts for mounting of illuminated cabinet signs. Wind load requirements.
- B. Section 10 1416 - Plaques: Cast metal plaques.
- C. Section 10 1419 - Dimensional Letter Signage: Cut and formed metal logos and letters.
- D. Section 10 1423 - Panel Signage: Exterior and interior panel signage.
- E. Section 10 1426 - Post and Panel Signage: Site navigation signage.
- F. Division 26 - Electrical, and Electrical Drawings: Coordination of electrical requirements.

**1.03 REFERENCE STANDARDS**

- A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- D. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

**1.04 SUBMITTALS**

- A. General: Refer to Specifications Section 01 300 Administrative Requirements for submittal requirements and procedures.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: Include fabrication and installation details for signs and mounting devices showing mounting heights, locations of supports and accessories. Submit the following:
  - 1. Layouts for each sign including typestyles and graphic elements.
  - 2. Mounting heights, locations of supports and accessories.
  - 3. Wiring diagrams: Power and control wiring.
- D. Selection Samples: Submit color chips or original hardcopy of color selection chart showing manufacturer's full range of colors and sheens.
- E. Verification Samples: Submit the following samples for verification:
  - 1. Metal chips with powder coated finish, representing selected colors and sheens.
  - 2. Acrylic sheet, 8 by 10 inches.
  - 3. Acrylic sheet with translucent and opaque finish; for exterior, 8 by 10 inches.
  - 4. Samples of translucent film in each color required.
- F. Calculations: Submit structural calculations including wind loadings, prepared, signed, and sealed by a professional engineer registered in North Carolina. Include structural calculations

for sign construction and anchorage indicating installed signs will resist wind loads per requirements of NC Building Code, ASCE 7, and as indicated on structural drawings.

G. Qualifications: Refer to "Quality Assurance" Article.

## **1.05 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with applicable provisions in Americans with Disabilities Act, ICC A117.1-2009, and North Carolina Building Building Code.
- 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. Fabricator Qualifications:
  - 1. Minimum 5 years experience in fabrication of illuminated cabinet signage.
  - 2. Submit a project reference list and photos of public or commercial exterior projects currently using signage and information systems supplied by the manufacturer.

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

- A. Deliver, store, and handle materials in accordance with Section 01 6000, Product Requirements and Manufacturer's instructions. Store in dry, secure location, protected against direct sunlight and excessive heat.

## **PART 2 – PRODUCTS**

### **2.01 CABINET SIGNS**

- A. Performance requirements: Design signs to resist wind loads as required by NC Building Code, ASCE 7, and as indicated on structural drawings.
- B. Mounument Sign: Double-sided, internal post-mounted, internally illuminated.
  - 1. Cabinet Sign Frames: Extruded-aluminum frames mitered with concealed anchors and welded, size as indicated on drawings. Coordinate attachments points on structural steel posts.
    - a. Finishes
      - 1) Exterior of Box: As selected by Architect from manufacturer's full range of colors and sheens.
      - 2) Interior of Box: White, reflective.
  - 2. Panel Material: White translucent acrylic sheet.
  - 3. Artwork: Custom, multi-color design; text and graphics to be provided by Architect.
    - a. Artwork Materials:
      - 1) Exterior Sign Panels:
        - (a) Opaque areas of exterior sign panels shall be painted.
        - (b) Translucent portions of exterior signs shall be applied vinyl with protective top coat.
  - 4. Attachment: Fabricate brackets and fittings for internal post-mounted signs to suit cabinet sign construction and mounting conditions indicated on drawings. Coordinate with work of other trades to provide a complete and fuctional installed sign assembly.
- C. Wall-Mounted Sign: One-sided, wall-mounted, internally illuminated.
  - 1. Cabinet Sign Frames: Extruded-aluminum frames mitered with concealed anchors and welded, fabricated to shape indicated on drawings.
    - a. Finishes
      - 1) Exterior of Box: As selected by Architect from manufacturer's full range of colors and sheens.
      - 2) Interior of Box: White, reflective.
  - 2. Panel Material: White translucent acrylic sheet.
  - 3. Brackets: Fabricate concealed brackets and fittings for wall-mounted signs to suit cabinet sign construction and mounting conditions indicated. Coordinate with work of other trades to provide a complete and fuctional installed sign assembly.

4. Accessories: Bird control spikes, 3 inch width.

## **2.02 MATERIALS**

- A. Aluminum Sheet and Plate: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 5005-H32.
- B. Aluminum Extrusions: ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 6063-T5.
- C. Acrylic Sheet: Acrylic sheet shall be nominal 1/4 inch thick minimum, translucent white, UV resistant, satin texture, extruded, impact- and scratch- resistant surface.
- D. Applied Vinyl: Cast vinyl film for internally illuminated signs approved by film manufacturer for application to substrate. Film shall have matte surface finish with uniform color in both reflected and transmitted light; clear, permanent, pressure- sensitive adhesive; and a translucent synthetic liner. Thickness of film without adhesive: 2 mils. Overall thickness of film: 3 to 4 mils. Tensile strength: 5 pounds/inch at 73 degrees Fahrenheit. Chemical resistance: Resists mild alkalis, mild acids, and salt. Film shall be suitable for exterior use.
- E. Applied Vinyl with Protective Top Coat: For detailed specifications for this film, refer to "Applied Vinyl" herein with the addition of protective top coat with low-sheen finish.
- F. Paint: Multi-component opaque paint material consisting of pigmented base and activator; UV resistant; satin sheen; acrylic polyurethane. Use primer and undercoats as recommended in writing by paint manufacturer for specific substrate.
- G. Gaskets and Seals: Provide neoprene gaskets.
- H. Bird Control Components:
  1. Base: UV-protected polycarbonate, bendable to fit contours of top of sign.
  2. Spikes: Fabricated from 316 stainless steel, permanently anchored in base.
  3. Basis of Design: Bird-B-Gone; Bird Spike 2001: [www.birdbgone.com](http://www.birdbgone.com).
  4. Other Manufacturers:
    - a. Bird Barrier America, Inc.: [www.birdbarrier.com](http://www.birdbarrier.com).
    - b. Bird-X: [www.bird-x.com](http://www.bird-x.com).
    - c. Substitutions: See Section 01 6000 - Product Requirements.

## **2.03 ACCESSORIES**

- A. Anchors and Fasteners: Provide stainless steel anchorages and fasteners.

## **2.04 ELECTRICAL**

- A. The light fixture shall be LED and consist of a luminaire assembly, driver, and mounting hardware.
  1. Light Fixtures: LED Chain Signage Modules:
    - a. The luminaire shall be rated minimum 67 lumen per module and 135 lumen per foot. Beam angle: 120 degrees.
    - b. Correlated Color Temperature (CCT): Minimum 6500K.
    - c. Modules shall be waterproof design, minimum IP66.
    - d. Longevity: A minimum of 50,000 operating hours before reaching the L70 lumen output degradations point without catastrophic failure.
    - e. Fixture shall be UL listed.
  2. Low voltage power supply for signs:
    - a. Operating input voltage: Coordinate with electrical requirements indicated on drawings and specifications.
    - b. Operating output voltage: 12 VDC.
    - c. Operating temperature: -20 degrees Celsius to 50 degrees Celsius.
    - d. Shall have minimum IP66 rating for wet location use.
    - e. Fixture shall be UL listed.

## **2.05 FABRICATION**

- A. General: Provide signs of configurations indicated.
  - 1. Welded Connections: Comply with applicable AWS standards metal and weld type for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.
  - 2. Mill joints to tight, hairline fit. Form exposed joints to exclude water penetration and provide gasketing and seals to form weather-tight assembly. Form joints to eliminate light leaks.
  - 3. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.
  - 4. Each sign face shall be fabricated from a single sheet of acrylic; splices or seams are not permitted.
- B. Shop assemble units and apply finishes and graphics in accordance with the Contract Drawings, manufacturer's standards, and approved Shop Drawings.

## **2.06 ARTWORK**

- A. The Contractor shall furnish a graphic layout showing the required logos, fonts, and layout of sign for use by the Contractor. The Contractor shall develop and complete final artwork for fabrication of each sign panel based on text and graphics provided by Architect.

## **2.07 ALUMINUM FINISHES**

- A. Paint or powder-coat finish, at fabricator's option.
- B. Paint Finish: Acrylic polyurethane paint.
- C. Powder-Coat Finish: Provide AAMA 2604 finish with minimum dry film thickness of
  - 1. 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
- D. Color and Sheen:
  - 1. Exterior of Box: As selected by Architect from manufacturer's full range of colors and sheens.
  - 2. Interior of Box: White, reflective.

## **2.08 STEEL FINISHES**

- A. Galvanizing: Hot-dip galvanize products made from rolled, pressed, and forged steel shapes, castings, plates, bars, and strips indicated to be galvanized shall comply with ASTM A123/A123M.
  - 1. Hot-dip galvanized steel and iron hardware indicated to be galvanized shall comply with ASTM A153/A153M.
  - 2. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
- B. Powder-Coat Finish, Non-Galvanized Metal: Prepare, treat, and coat non-galvanized ferrous metal to comply with resin manufacturer's written instructions and as follows:
  - 1. Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No.3.
  - 2. Apply AAMA 2604 thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils or resin manufacturer's recommended thickness, whichever is greater.
  - 3. Color and Sheen: As selected by Architect from manufacturer's full range of colors and sheens.
- C. Powder-Coat Finish, Galvanized Metal: Prepare, treat, and coat galvanized metal to comply with resin manufacturer's written instructions and as follows:
  - 1. Prepare galvanized metal by thoroughly removing grease, dirt, oil, flux, and other foreign matter.
  - 2. Treat prepared metal with zinc-phosphate pretreatment, rinse, and seal surfaces.

3. Apply AAMA 2604 thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils or resin manufacturer's recommended thickness, whichever is greater.
4. Color and Sheen:
  - a. Exterior of Box: As selected by Architect from manufacturer's full range of colors and sheens.
  - b. Interior of Box: White, reflective.

## **PART 3 – EXECUTION**

### **3.01 EXAMINATION**

- A. Verify location of electrical rough-ins, and confirm circuit compatibility with sign lighting electrical characteristics.
- B. Verify that substrates have been adequately prepared to securely anchor signage units.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly prior to installation.
- B. Protect surrounding work from damage by work of this Section.

### **3.03 INSTALLATION**

- A. Install signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions and approved Shop Drawings.
- B. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
- C. Internal Post-Mounted Signs: Provide fittings and hardware for mounting signs that attach to internal posts. Attach sign securely to posts to comply with Contract Documents and approved Shop Drawings.
- D. Bracket-Mounted Signs: Provide brackets, fittings, and hardware for mounting signs that attach to walls. Attach brackets and fittings securely to walls and ceilings with concealed fasteners and anchoring devices to comply with Contract Documents and approved Shop Drawings.
- E. Coordinate with other trades for attachment to other work and electrical connections.

### **3.04 CLEANING AND PROTECTION**

- A. Clean exposed surfaces in accordance with manufacturer's instructions.
- B. Protect from damage until date of Substantial Completion.

**END OF SECTION 10 1433**

**SECTION 10 2113.17  
PHENOLIC TOILET COMPARTMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Phenolic toilet compartments.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Blocking and supports.
- B. Section 10 2800 - Toilet, Bath, and Laundry Accessories.

**1.03 REFERENCE STANDARDS**

- A. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on panel construction, hardware, and accessories.
- C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
- D. Selection Samples: Physical samples of manufacturer's full range of colors and patterns.
- E. Manufacturer's Installation Instructions: Indicate special procedures.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Phenolic Toilet Compartments:
  - 1. All American Metal Corp - AAMCO; Essential Privacy: [www.allamericanmetal.com/#sle](http://www.allamericanmetal.com/#sle).
  - 2. ASI Accurate Partitions; Ultimate Privacy: [www.asi-accuratepartitions.com/#sle](http://www.asi-accuratepartitions.com/#sle).
  - 3. ASI Global Partitions; Ultimate Privacy: [www.asi-globalpartitions.com/#sle](http://www.asi-globalpartitions.com/#sle).
  - 4. Hadrian: [www.hadrian-inc.com/#sle](http://www.hadrian-inc.com/#sle).
  - 5. Substitutions: Section 01 6000 - Product Requirements.

**2.02 PHENOLIC TOILET COMPARTMENTS**

- A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid phenolic core panels with integral melamine finish, floor-mounted headrail-braced, zero sightline construction.
- B. Doors:
  - 1. Thickness: 3/4 inch.
  - 2. Width: 24 inch.
  - 3. Width for Handicapped Use: 36 inch, out-swinging.
  - 4. Height: 58 inch.
- C. Panels:
  - 1. Thickness: 1/2 inch.
  - 2. Height: 58 inch.
  - 3. Depth: As indicated on drawings.
- D. Pilasters:
  - 1. Thickness: 3/4 inch.
  - 2. Width: As required to fit space; minimum 3 inch.

## **2.03 ACCESSORIES**

- A. Pilaster Shoes: Formed ASTM A666 Type 304 stainless steel with No. 4 finish, 3 inch high, concealing floor fastenings.
  - 1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
- B. Head Rails: Hollow stainless steel or anodized aluminum, 1 inch by 1-1/2 inch size, with anti-grip profile and cast socket wall brackets.
- C. Wall and Pilaster Brackets: satin stainless steel or natural anodized aluminum; continuous type.
- D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
- E. Hardware: Polished stainless steel:
  - 1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
  - 2. Door Latch: Slide type with exterior emergency access feature and occupancy indicator.
  - 3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
  - 4. Coat hook with rubber bumper; one per compartment, mounted on door.
  - 5. Provide door pull for outswinging doors.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify correct spacing of and between plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing.

### **3.02 INSTALLATION**

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.
- E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

### **3.03 TOLERANCES**

- A. Maximum Variation From True Position: 1/4 inch.
- B. Maximum Variation From Plumb: 1/8 inch.

### **3.04 ADJUSTING**

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.
- B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.
- C. Adjust adjacent components for consistency of line or plane.

**END OF SECTION 10 2113.17**

**SECTION 10 2600  
WALL AND DOOR PROTECTION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Corner guards.
- B. Protective wall covering.

**1.02 RELATED REQUIREMENTS**

- A. Section 08 7100 - Door Hardware: Standard protection plates and trim.

**1.03 REFERENCE STANDARDS**

- A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2023, with Editorial Revision.
- B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents; 2021.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- D. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies; 2023.
- E. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate physical dimensions, features, and installation instructions.
- C. Color Selections Samples: Submit physical samples in manufacturer's full range of colors and patterns for selection by Architect.
- D. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Stock Materials: For each color, provide two minimum 48 inches long units of corner guards.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver wall protection items in original, undamaged protective packaging. Label items to designate installation locations.
- B. Protect work from moisture damage.
- C. Protect work from UV light damage.
- D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.
- E. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Protective Wall Covering and Corner Guards:
  - 1. Construction Specialties, Inc; Acrovyn High-Impact Wall Covering: [www.c-sgroup.com/#sle](http://www.c-sgroup.com/#sle).
  - 2. Inpro; Palladium: [www.inprocorp.com/#sle](http://www.inprocorp.com/#sle).

3. Koroseal; Koroguard: [www.koroseal.com](http://www.koroseal.com).
4. Substitutions: See Section 01 6000 - Product Requirements.

## **2.02 PERFORMANCE CRITERIA**

- A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.
- B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.
- C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.

## **2.03 PRODUCT TYPES**

- A. Protective Wall Covering and Corner Guards:
  1. Material: High-impact acrylic-modified vinyl.
  2. Thickness: 0.040 inch.
  3. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
  4. Color: As selected from manufacturer's full range of colors and patterns Allow for one color/pattern in each room.
  5. Texture: Suede.
  6. Corner Guards
    - a. Width of Wings: 1-1/2 inches.
    - b. Length: One piece, 48 inches.
  7. Accessories: Provide manufacturer's standard color-matched trim and moldings.
  8. Mounting: Adhesive.
- B. Adhesives and Primers: As recommended by manufacturer.

## **2.04 FABRICATION**

- A. Fabricate components with tight joints, corners and seams.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate surfaces for adhered items are clean and smooth.
  1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer. Follow adhesive manufacturer's recommendations for remedial measures at locations and/or application conditions where adhesion test's results are unsatisfactory.
- B. Start of installation constitutes acceptance of project conditions.

### **3.02 INSTALLATION**

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.
- B. Position corner guard 4 inches above finished floor to 48 inches high.
- C. Position protective wall covering no less than 1 inch above finished floor to allow for floor level variation.
  1. Wainscot Installation: Establish a level line at the specified height for entire length of run. Install by aligning top of edge of covering with this line.
  2. Apply adhesive with 1/8 inch V-notch trowel to an area of wall surface that can be completed within cure time of the adhesive.
  3. Install trim pieces as required for a complete installation. Allow tolerance for thermal movement.

4. At joints indicated to be caulked, allow for a minimum 1/16 inch wide gap between edges of sheets. Gaps are required to be of consistent width throughout the project.
5. Use a roller to ensure maximum contact with adhesive.
6. At inside and outside corners cut covering sheets to facilitate installation of trim pieces or corner guards.

### **3.03 TOLERANCES**

- A. Maximum Variation From Required Height: 1/4 inch.
- B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

### **3.04 CLEANING**

- A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

**END OF SECTION 10 2600**

**SECTION 10 2800**  
**TOILET, BATH, AND LAUNDRY ACCESSORIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Commercial toilet accessories.
- B. Diaper changing stations.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 1000 - Summary: Items to be furnished by the Owner and installed by the contractor.
- B. Section 06 1000 - Rough Carpentry: Concealed blocking to support accessories.
- C. Section 10 2113.17 - Phenolic Toilet Compartments.
- D. Section 22 4000 - Plumbing Fixtures: Under-lavatory pipe and supply covers.

**1.03 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2022.
- D. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
- E. ASTM C1036 - Standard Specification for Flat Glass; 2021.
- F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- G. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2022.
- H. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Basis of Design: Unless noted otherwise, basis of design products are manufactured by Bobrick Washroom Equipment, Inc.; [www.bobrick.com](http://www.bobrick.com). Some accessories are to be furnished by Owner and installed by the Contractor, see drawings and Section 01 1000 - Summary for additional information.
- B. Other Manufacturers of Commercial Toilet, Shower, and Bath Accessories:
  - 1. American Specialties, Inc: [www.americanspecialties.com/#sle](http://www.americanspecialties.com/#sle).
  - 2. Bradley Corporation: [www.bradleycorp.com/#sle](http://www.bradleycorp.com/#sle).
  - 3. Substitutions: Section 01 6000 - Product Requirements.
- C. Other Manufacturers of Diaper Changing Stations:
  - 1. American Specialties, Inc: [www.americanspecialties.com/#sle](http://www.americanspecialties.com/#sle).

2. Bradley Corporation: [www.bradleycorp.com/#sle](http://www.bradleycorp.com/#sle).
  3. Substitutions: 01 6000 - Product Requirements.
- D. Provide products of each category type by single manufacturer.

## **2.02 MATERIALS**

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
  1. Grind welded joints smooth.
  2. Fabricate units made of metal sheet or seamless sheets with flat surfaces.
- B. Stainless Steel Sheet: ASTM A666/A666M, Type 304.
- C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- D. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.
- E. Fasteners, Screws, and Bolts: Hot dip galvanized or stainless steel.
- F. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

## **2.03 FINISHES**

- A. Stainless Steel: Satin finish, unless otherwise noted.
- B. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.

## **2.04 COMMERCIAL TOILET ACCESSORIES**

- A. Toilet Paper Dispenser: Furnished by Owner, installed by GC.
- B. Paper Towel Dispenser: Furnished by Owner, installed by GC.
- C. Waste Receptacle: semi-recessed, stainless steel, seamless lower door for access to container, continuously welded bottom pan and seamless exposed flanges.
  1. Liner: Removable rigid molded plastic receptacle.
  2. Minimum capacity: 12 gallons.
  3. Basis of Design Product: Model B-43644 by Bobrick.
- D. Soap Dispenser: Furnished by Owner, installed by GC.
- E. Mirrors: Stainless steel framed, 1/4 inch thick tempered safety glass; ASTM C1048.
  1. Size: 24 by 36 inches.
  2. Frame: Heavy gauge angles with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
  3. Basis of Design Product: Model B-290 by Bobrick.
- F. Grab Bars: Stainless steel, textured surface.
  1. Standard Duty Grab Bars:
    - a. Push/Pull Point Load: 250 pound-force, minimum.
    - b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
    - c. Finish: Satin.
    - d. Length and Configuration: 18, 36, and 42 inch as indicated on drawings.
    - e. Basis of Design Product: Model B-5806 by Bobrick.
- G. Sanitary Napkin Disposal Unit: Furnished by Owner, installed by GC.
- H. Utility Hook: Heavy-duty stainless steel, surface mounted, stainless steel mounting bracket and backplate for concealed attachment, satin stainless steel finish.
  1. Basis of Design Product: Model B-6707 by Bobrick.

## **2.05 DIAPER CHANGING STATIONS**

- A. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
  - 1. Material: Stainless steel.
  - 2. Mounting: Surface.
  - 3. Minimum Rated Load: 200 pounds.
  - 4. Basis of Design Product: Model KB-310SSWM manufactured by Koala Kare, a division of Bobrick.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. Verify that field measurements are as indicated on drawings.

### **3.02 PREPARATION**

### **3.03 INSTALLATION**

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

### **3.04 PROTECTION**

- A. Protect installed accessories from damage due to subsequent construction operations.

**END OF SECTION 10 2800**

**SECTION 10 4400  
FIRE PROTECTION SPECIALTIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fire extinguisher cabinets.
- B. Accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 1000 - Summary: Items to be provided by owner; fire extinguishers.
- B. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide color and finish, anchorage details, installation instructions, and product information showing dimensions, features, and options of fire extinguisher cabinets.
- C. Color Selection Samples: Painted metal chips or hardcopy of manufacturer's color chart.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Fire Extinguisher Cabinets and Accessories:
  - 1. Activar Construction Products Group, Inc. - JL Industries; Ambassador Series: [www.activarcpg.com/#sle](http://www.activarcpg.com/#sle).
  - 2. Fire-End & Croker Corporation; 1600 Series: [www.croker.com/#sle](http://www.croker.com/#sle).
  - 3. Larsen's Manufacturing Co; Architectural: [www.larsensmfg.com/#sle](http://www.larsensmfg.com/#sle).
  - 4. Nystrom, Inc.; Alpine: [www.nystrom.com](http://www.nystrom.com)
  - 5. Potter-Roemer; 7007: [www.potterroemer.com/#sle](http://www.potterroemer.com/#sle).
  - 6. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 FIRE EXTINGUISHER CABINETS**

- A. Cabinet Construction: Non-fire rated.
  - 1. Formed primed steel sheet; 0.036 inch thick base metal.
- B. Cabinet Configuration: Recessed type.
  - 1. Interior nominal dimensions of 10-1/2 inch wide by 24 inch high by 6 inch deep.
  - 2. Trim: Flat square edge.
  - 3. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim.
- C. Door: Reinforced for flatness and rigidity with roller type catch. Hinge doors for 180 degree opening with continuous piano hinge.
- D. Door Glazing: Acrylic plastic, clear, 1/8 inch thick, flat shape and set in resilient channel glazing gasket.
- E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- F. Fabrication: Weld, fill, and grind components smooth.
- G. Finish of Cabinet Exterior Trim and Door: Baked enamel, color as selected.

**2.03 ACCESSORIES**

- A. Lettering: "FIRE EXTINGUISHER" decal, or vinyl self-adhering, prespaced black lettering in accordance with authorities having jurisdiction (AHJ).

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, 24 inches from finished floor to inside bottom of cabinet.
- C. Secure rigidly in place.

**END OF SECTION 10 4400**

**SECTION 11 1700  
TELLER AND SERVICE EQUIPMENT**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Interior through-wall book depositories.
- B. Exterior through-wall book depositories.
- C. Book trucks.

**1.02 RELATED REQUIREMENTS**

- A. Section 04 2000 - Unit Masonry: Masonry openings, lintels, and flashings.
- B. Section 06 1000 - Rough Carpentry: Rough openings in wood framed walls.
- C. Section 07 2700 - Air Barriers: Sealing book depository units to air barrier installed on adjacent construction.
- D. Section 07 9200 - Joint Sealants: Sealing joints between book depository units and adjacent construction.

**1.03 REFERENCE STANDARDS**

- A. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2024.
- B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate work with adjacent materials specified in other sections and as indicated on drawings and approved shop drawings.
- B. Coordinate rough-in requirements, and install sealants and air barrier materials to maintain continuity of air barrier and direct drainage of moisture to building exterior.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's product data for specified products indicating materials, operation, finishes, text options, accessories, and installation instructions.
- C. Shop Drawings: Indicate configuration, sizes, rough-in, mounting, anchors and fasteners, and installation clearances.
- D. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver units in manufacturer's original packaging and unopened containers with identification labels intact.
- B. Store units in area protected from exposure to weather and vandalism.

**1.07 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Provide manufacturer's warranty for a minimum of two years from date of delivery covering all components, and lifetime warranty against structural failure or rust through for aluminum and stainless steel components.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Basis of Design Manufacturer: Kingsley Companies; [www.kingsley.com](http://www.kingsley.com).
- B. Other Acceptable Manufacturers:

1. American Security Cabinets/American Book Returns; [www.americansecuritycabinets.com](http://www.americansecuritycabinets.com).
2. Brichard Company; [www.brichard.biz](http://www.brichard.biz).
3. Substitutions: See Section 01 6000-Product Requirements.

## **2.02 INTERIOR THROUGH-WALL BOOK DEPOSITORIES**

- A. Location: Built within interior wall, as indicated on drawings.
- B. Construction:
  1. Face Plate and Depository Door: Stainless steel face plate and depository door flap.
  2. Body of Depository and Chute: Aluminum.
- C. Operation: Upward-opening door, gravity and weight balanced, self-closing. Door lockable from inside via thumbscrews.
- D. Wording: Text on customer side of book depository reading "LIBRARY RETURN". Wording to be routed into face plate and painted black.
- E. Braille Labels: ADA compliant, self-adhesive, braille text reading "Book Drop".
- F. Basis of Design Product:
  1. Kingsley; #K-TWHP Interior HallPass ThruWall: [www.kingsley.com](http://www.kingsley.com).
  2. Substitutions: See Section 01 6000 - Product Requirements.

## **2.03 EXTERIOR THROUGH-WALL BOOK DEPOSITORIES**

- A. Location: Built within exterior wall, as indicated on drawings.
- B. Construction:
  1. Face Plate and Depository Door: Stainless steel face plate and depository door flap.
  2. Body of Depository and Chute: Aluminum.
  3. Extension Accessory: Extension kit with longer aluminum slide, and extendable chute add-on that telescopes over the book depository, for walls up to 24 inches thick.
- C. Operation: Upward-opening door, gravity and weight balanced, self-closing, with magnetic closure assistance to resist wind and blowing rain. Door lockable from inside.
- D. Wording: Text on customer side of book depository reading "LIBRARY RETURN". Wording to be routed into face plate and painted black.
- E. Braille Labels: ADA compliant, self-adhesive, braille text reading "Book Drop".
- F. Basis of Design Product:
  1. Kingsley; #K-TWEZ Ease ThruWall, with ThruWall Extension Kit: [www.kingsley.com](http://www.kingsley.com).
  2. Substitutions: See Section 01 6000 - Product Requirements.

## **2.04 BOOK TRUCKS**

- A. Quantity: Provide one book truck for each through-wall book depository.
- B. Construction:
  1. Body: Minimum 16 gauge aluminum, with fixed handle. Self-leveling float tray that lowers as materials are added, and raises as they are removed.
  2. Padding: All book trucks to have water resistant felt padding on float tray. Book truck at interior wall depository to also have heavy duty felt padding on all four walls of the cart body.
  3. Casters: 5 inch diameter corner mount casters; two rigid and two swivel with locking feature. Non-marring wheels, with ball bearings.
- C. Basis of Design Product:
  1. Kingsley; #K-ER50QD 50 DuraLight EasyRoller CushionDrop Cart for interior wall depository, #K-ER60 60 DuraLight EasyRoller Cart for exterior wall depository: [www.kingsley.com](http://www.kingsley.com).
  2. Substitutions: See Section 01 6000 - Product Requirements.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Notify Architect if conditions are not suitable for installation of units; do not proceed until conditions are satisfactory.

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions. Verify mounting height to comply with ADA requirements, and to provide clearance for book trucks.
- B. Anchor units securely per manufacturer's instructions.
- C. Install insulating foam sealant around perimeter of unit at stud wall to maintain continuity of thermal barrier. Seal flange at masonry opening to prevent intrusion of bulk water into masonry cavity.
- D. Install air barrier materials to maintain continuity of air barrier where unit penetrates wall, and direct drainage of moisture to building exterior.
- E. Remove and replace defective work.

### **3.03 ADJUSTING**

- A. Adjust operating components for smooth operation while also maintaining a secure, weather-tight enclosure.

### **3.04 CLEANING**

- A. Remove protective material from factory finished surfaces.
- B. Clean exposed surfaces promptly after installation without damaging finishes.

### **3.05 DEMONSTRATION**

- A. Train Owner's maintenance personnel to adjust, operate, and maintain units.
  - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

### **3.06 PROTECTION**

- A. Provide temporary protection to ensure that book depository units and book trucks are without damage upon Date of Substantial Completion.

**END OF SECTION 11 1700**

## **SECTION 11 5213 PROJECTION SCREENS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Front projection screen assemblies.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Wood blocking in walls.
- B. Section 09 5100 - Acoustical Ceilings: Suspended panel ceilings for recessed screens.
- C. Division 26: Electrical supply, conduit, and wiring for electric motor operated projection screens.
- D. Section 26 0583 - Wiring Connections: Electrical supply, conduit, and wiring for electric motor operated projection screens.

#### **1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's catalog cuts and descriptive information on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
  - 4. Wiring diagrams for motor operators and actuators, and controls and switches.
- C. Operation and Maintenance Data: Provide manufacturer's operation and maintenance instructions.
- D. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

#### **1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver projection screens to project site in manufacturer's original unopened packaging, and inspect for damage and proper size before accepting delivery.
- B. Store in a protected, clean, dry area with temperature maintained above 50 degrees F, and stack in accordance with manufacturer's recommendations.
- C. Acclimate screens to building temperatures for 24 hours prior to installation, in accordance with manufacturer's recommendations.

#### **1.05 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for projection screen assembly.

### **PART 2 PRODUCTS**

#### **2.01 FRONT PROJECTION SCREENS**

- A. Basis of Design: Draper, Inc.; Ceiling-Recessed - Access E, Wall Mounted - Acumen XL E: [www.draperinc.com](http://www.draperinc.com).
- B. Other Acceptable Manufacturers:
- C. Da-Lite Screen Company: [www.legrand.us/da-lite.com](http://www.legrand.us/da-lite.com).
- D. Elite Screens Projector Screens: [www.elitescreens.com](http://www.elitescreens.com).
- E. Substitutions: See Section 01 6000 - Product Requirements.
- F. Front Projection Screens: Factory assembled unless otherwise indicated.
  - 1. Located in Multipurpose Room 110: Motorized, matte light diffusing fabric screen, wall mounted.

- a. Screen Viewing Area: 90 inch high by 160 inch wide.
- 2. Located in Meeting Room 106: Motorized, matte light diffusing fabric screen, ceiling recessed.
  - a. Screen Viewing Area: 58 inch high by 104 inch wide.
- G. Matte Light Diffusing Fabric: Light diffusing screen fabric; washable, flame retardant and mildew resistant.
  - 1. Material: High contrast gray vinyl on fiberglass backing, with nominal gain of 0.8 over viewing angle not less than 70 degrees from axis, horizontally and vertically.
- H. Masking Borders: Black, on four sides.
- I. Exposed Screen Cases: Aluminum, with integral roller brackets.
  - 1. Finish: Baked enamel.
  - 2. Color: White.
  - 3. End Caps: Manufacturer's standard material; finished to match case.
  - 4. Mounting: Wall.
- J. Concealed-in-Ceiling Screen Cases: Steel, with integral roller brackets.
  - 1. Door Slat: Self trim; self-closing and -opening.
  - 2. Case Finish: Baked enamel.
  - 3. Case Color: White.
- K. Electrically-Operated Screens:
  - 1. Roller: Steel, minimum 3 inch in diameter.
  - 2. Vertical Tensioning: Screen fabric weighted at bottom with steel or aluminum bar and plastic end caps.
  - 3. Horizontal Tensioning: Not required.
- L. Provide mounting hardware, brackets, supports, fasteners, and other mounting accessories required for a complete installation, in accordance with manufacturer's recommendations for specified substrates and mountings.

## **2.02 ELECTRICAL COMPONENTS**

- A. Electrical Components: Listed and classified by UL as suitable for the purpose specified and indicated.
- B. Motors and controls: Low-voltage motor with internal low-voltage control module and 3-button low-voltage wall switch.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate is finished and ready to accept screen installation.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that openings in ceiling grid for recessed screens are correctly sized.
- D. Verify type and location of electrical connections.
- E. Do not install projection screens until climate control systems are in place and interior painting and other finishes are completed.

### **3.02 PREPARATION**

- A. Coordinate screen installation with installation of projection systems.
- B. Coordinate installation with adjacent construction and fixtures, including ceilings, walls, lighting, fire suppression, and registers and grilles.

### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions, using manufacturer's recommended hardware for relevant substrates.

- B. Do not field cut screens.
- C. Install screens in mountings as specified and as indicated on drawings.
- D. Install plumb and level.
- E. Install electrically operated screens ready for connection to power and control systems by others.
- F. Adjust projection screens and related hardware in accordance with manufacturer's instructions for proper placement and operation.
- G. Test electrical screens for proper working condition. Adjust as needed.

#### **3.04 PROTECTION**

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

**END OF SECTION 11 5213**

## **SECTION 11 5271 PROJECTOR MOUNTS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. s.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 09 5100 - Acoustical Ceilings: Suspended panel ceilings to receive projector mount.
- B. Division 26: Electrical supply, conduit, and wiring.
- C. Division 27: Communications cabling.

#### **1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's catalog cuts and descriptive information on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
- C. Samples: For projector mount finish, submit color selection samples or original printed color chart showing manufacturer's standard range of colors.
- D. Operation and Maintenance Data: Provide manufacturer's operation and maintenance instructions.

#### **1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver projector mounts to project site in manufacturer's original unopened packaging, and inspect for damage and proper size before accepting delivery.
- B. Store in a protected, clean, dry area with temperature maintained above 50 degrees F.

### **PART 2 PRODUCTS**

#### **2.01 PROJECTOR MOUNTS**

- A. Basis of Design: Chief, a division of Legrand AV, Inc.: [www.legrandav.com/products/chief](http://www.legrandav.com/products/chief).
  - 1. Suspended Ceiling Projector Mount System: SYSAU Universal Suspended Ceiling Mount Kit.
  - 2. Ceiling Projector Mount System: RPA Universal Ceiling Projector Mount Kit.
- B. Other Acceptable Manufacturers:
  - 1. Crimson AV, LLC: [www.crimsonav.com](http://www.crimsonav.com).
  - 2. Peerless-AV: [www.peerless-av.com](http://www.peerless-av.com).
- C. Substitutions: See Section 01 6000 - Product Requirements.
- D. Suspended Ceiling Projector Mount System: Complete projector mount system kit for installation in suspended ceiling.
  - 1. Location: Meeting Room 106.
  - 2. Components:
    - a. Ceiling Plate:
      - 1) Set screws to secure plate to ceiling grid
      - 2) Column collar, with travel provided to adjust column location horizontally, and connections to secure column safely and rigidly at the required height and in the correct orientation.
      - 3) Knockout for installation of electrical and communications connections.
    - b. Projector Mount and Column with Cable Pass-Through:
      - 1) Adjustability: Knobs for precision, independent adjustment of pitch, yaw, and roll, and set screws to lock in desired orientation.

- 2) Vertical Adjustment Range: 12 inches, in 1/2 inch increments.
- c. Universal Interface: Interface plate with projector lens direction alignment marks, and adjustable legs.
- d. Trim: Escutcheon to cover column penetration through acoustical ceiling tile.
- 3. Finish: Color as selected by Architect from manufacturer's standard range.
- E. Ceiling Projector Mount System: Complete mounting system for installation on exposed ceiling.
  - 1. Location: Multipurpose Room 110.
  - 2. Components:
    - a. Angled Ceiling Adapter: Adjustable for mounting on angled ceilings, with set screw to lock in desired orientation.
    - b. Column: Adjustable length extension column with cable pass-through, length adjustable from 9 to 11 ft in 1 inch increments. Verify length and adjustment range with Architect prior to ordering.
    - c. Projector Mount: Adjustable for pitch, yaw, and roll, and set screws to lock in desired orientation.
    - d. Universal Interface Bracket: Interface plate and adjustable legs.
  - 3. Finish: Color as selected by Architect from manufacturer's standard range.
- F. Accessories: Provide mounting hardware, brackets, supports, fasteners, and other mounting accessories required for a complete installation, in accordance with manufacturer's recommendations for specified substrates and mountings.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate is finished and ready to accept projector mount installation.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that openings in ceiling grid for projector mounts are correctly sized.
- D. Verify type and location of electrical and communications connections.

### **3.02 PREPARATION**

- A. Coordinate mount installation with installation of projection screens and audio/visual systems.
- B. Coordinate installation with adjacent construction and fixtures, including ceilings, walls, lighting, fire suppression, ducts, registers, and grilles.

### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions, using manufacturer's recommended hardware for relevant substrates.
- B. Install mounts at locations indicated on drawings.
- C. Install plumb and level.
- D. Install projector mounts ready for connection to power and control systems, and for installation of projector to be furnished and installed by Owner.
- E. Adjust projector mounts and related hardware in accordance with manufacturer's instructions for proper placement and operation.

### **3.04 PROTECTION**

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

**END OF SECTION 11 5271**

**SECTION 12 1230  
ART HANGING AND DISPLAY SYSTEMS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Gallery-type art hanging and display systems.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Concealed blocking to support wall tracks.

**1.03 REFERENCE STANDARDS**

- A. AAMA 6111 - Specification for Anodized Architectural Aluminum; 2024.
- B. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data:
  - 1. Manufacturer's documentation indicating materials, finishes, and load ratings.
  - 2. Preparation instructions and recommendations.
  - 3. Storage and handling requirements and recommendations.
  - 4. Instructions describing typical installation methods.
- C. Selection Samples: For each finish product specified, provide samples representing actual finishes.
- D. Maintenance Instructions: Manufacturer's instructions and recommendations for use and maintenance of system components and accessories.
- E. Specimen warranty.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with minimum 3 years of experience.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging and protect from damage until ready for installation.

**1.07 FIELD CONDITIONS**

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

**1.08 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide manufacturer's standard limited warranty.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Arakawa Hanging Systems: [www.arakawagrip.com](http://www.arakawagrip.com).
- B. AS Hanging Display Systems: [www.ashanging.com](http://www.ashanging.com).
- C. Gallery System Art Displays: [www.galleriesystems.com](http://www.galleriesystems.com).
- D. Picture Hang Solutions: [www.picturehangsolutions.com](http://www.picturehangsolutions.com).
- E. Systematic Art, Inc.: [www.systematicart.com](http://www.systematicart.com).
- F. Substitutions: See Section 01 6000 - Product Requirements.

- G. Source Limitations: Furnish products produced by single manufacturer and obtained from single supplier.

## **2.02 COMPONENTS**

- A. Tracks:
  - 1. Type: Wall-mounted.
  - 2. Material: Extruded aluminum
  - 3. Finish: As selected by Architect from manufacturer's full range.
  - 4. Quantity: See drawings for track locations lengths, and mounting heights.
- B. Hangers:
  - 1. Type: J-Hook with steel or stainless steel cable.
  - 2. Length: 6 ft
  - 3. Quantity: Provide a minimum of one hanger for each foot of track.
- C. Hooks:
  - 1. Type: Self-gripping, push button operation.
  - 2. Quantity: Provide a minimum of one hook for each hanger.

## **2.03 ACCESSORIES**

- A. Fasteners: As recommended by manufacturer for wall substrate.
- B. Track End Caps: Manufacturer's standard wall track end caps, finish to match or coordinate with selected finish for wall track.
- C. Clips: For installation at back of picture frames to help keep pictures from leaning too far forward on the hanging system, compatible with specified hangers.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

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

### **3.02 INSTALLATION**

- A. Install in accordance with drawings and manufacturer's written instructions.

### **3.03 TOLERANCES**

- A. Variation from Horizontal: 1/8 inch in 10 feet, maximum.
- B. Joints: 1/16 inch wide, maximum.

### **3.04 CLEANING**

- A. Clean products in accordance with manufacturer's recommendations.
- B. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.

### **3.05 PROTECTION**

- A. Protect installed products from subsequent construction operations.
- B. Touch up, repair or replace products damaged before Date of Substantial Completion.

**END OF SECTION 12 1230**

## **SECTION 12 2400 WINDOW SHADES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Interior manual roller shades.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).
- B. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.
- C. WCMA A100.1 - Standard for Safety of Window Covering Products; 2022.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Sequencing:
  - 1. Do not fabricate shades until field dimensions for each opening have been taken with field conditions in place.
  - 2. Do not install shades until final surface finishes and painting are complete.

#### **1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
- C. Selection Samples: Include fabric samples in full range of available colors and patterns.
- D. Verification Samples: Minimum size 6 inches square, representing actual materials, color and pattern.

#### **1.06 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing work of this type with minimum three years of documented experience with shading systems of similar size and type.

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

- A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.
- B. Handle and store shades in accordance with manufacturer's recommendations.

#### **1.08 FIELD CONDITIONS**

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Interior Manually Operated Roller Shades:
  - 1. Draper, Inc; Clutch Operated FlexShade NEXD: [www.draperinc.com/#sle](http://www.draperinc.com/#sle).
  - 2. Hunter Douglas Architectural; RB500 Manual Roller Shades: [www.hunterdouglasarchitectural.com/#sle](http://www.hunterdouglasarchitectural.com/#sle).
  - 3. Lutron Electronics Co., Inc; Contract Roller Manual Roller Shades: [www.lutron.com/#sle](http://www.lutron.com/#sle).
  - 4. SWFcontract, a division of Springs Window Fashions, LLC.; Pro Series Manual Shade System: [www.swfcontract.com/#sle](http://www.swfcontract.com/#sle).

- 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

## **2.02 ROLLER SHADES**

- A. General:
  - 1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
  - 2. Provide shade system that operates smoothly when shades are raised or lowered.
- B. Roller Shades:
  - 1. Description - Interior Roller Shades: Single roller, manually operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
    - a. Drop Position: Regular roll.
    - b. Roll Direction: Roll down, closed position is at window sill.
    - c. Mounting: Window jamb mounted - inside, between jambs.
    - d. Size: To fit window opening sizes indicated on drawings.
    - e. Fabric: As indicated under Shade Fabric article.
  - 2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
    - a. Material: Stamped steel.
  - 3. Roller Tubes: As required for type of shade operation.
    - a. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
  - 4. Hembars: Designed to maintain bottom of shade straight and flat.
  - 5. Manual Operation for Interior Shades:
    - a. Clutch Operator: Manufacturer's standard material and design, permanently lubricated.
    - b. Drive Chain: Continuous loop, beaded ball chain with restraining device, 95 lb minimum breaking strength; comply with WCMA A100.1. Provide upper and lower limit stops.
    - c. Chain Retainer:
      - 1) Chain tensioning device complying with WCMA A100.1.
  - 6. Accessories:
    - a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; clear anodized finish.
      - 1) Profile: Square.
    - b. End Caps: Provide manufacturer's standard end caps to cover exposed ends of brackets.
    - c. Fasteners: Noncorrosive, and as recommended by shade manufacturer.

## **2.03 SHADE FABRIC**

- A. Fabric for Light-Filtering Shades: Nonflammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
  - 1. Material: Vinyl coated polyester.
  - 2. Performance Requirements:
    - a. Flammability: Pass NFPA 701 large and small tests.
    - b. Fungal Resistance: No growth when tested in accordance with ASTM G21.
  - 3. Openness Factor: 3 percent.
  - 4. Color: As selected by Architect from manufacturer's full range of colors.

## **2.04 ROLLER SHADE FABRICATION**

- A. Field measure finished openings prior to ordering or fabrication.
- B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.

1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window stool.
  2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.
- C. Dimensional Tolerances: As recommended in writing by manufacturer.
- D. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine finished openings for deficiencies that may preclude satisfactory installation.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Start of installation shall be considered acceptance of substrates.

#### **3.02 PREPARATION**

- A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
- B. Coordinate with window installation and placement of concealed blocking to support shades.

#### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
- B. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.
- C. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

#### **3.04 CLEANING**

- A. Clean soiled shades and exposed components as recommended by manufacturer.
- B. Replace shades that cannot be cleaned to "like new" condition.

#### **3.05 CLOSEOUT ACTIVITIES**

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

#### **3.06 PROTECTION**

- A. Protect installed products from subsequent construction operations.
- B. Touch-up, repair, or replace damaged products before Substantial Completion.

**END OF SECTION 12 2400**

## **SECTION 12 3600 COUNTERTOPS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Countertops for architectural cabinet work.
- B. Window stools.

#### **1.02 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- B. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
- C. PS 1 - Structural Plywood; 2023.

#### **1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. 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. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.
- D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.
- F. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
- G. Installer's qualification statement.

#### **1.04 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

#### **1.06 FIELD CONDITIONS**

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

### **PART 2 PRODUCTS**

#### **2.01 COUNTERTOPS**

- A. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
  - 1. Flat Sheet Thickness: 1/2 inch, minimum.
  - 2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.

- a. Manufacturers:
  - 1) Dupont; Corian: [www.corian.com/#sle](http://www.corian.com/#sle).
  - 2) Formica Corporation; Everform Solid Surface: [www.formica.com/#sle](http://www.formica.com/#sle).
  - 3) LG Hausys America, Inc; HI-MACS 12mm: [www.lghausysusa.com/#sle](http://www.lghausysusa.com/#sle).
  - 4) Meganite, Inc; Meganite Solid Surface: [www.meganite.com/#sle](http://www.meganite.com/#sle).
  - 5) Wilsonart LLC; Wilsonart Solid Surface: [www.wilsonart.com/#sle](http://www.wilsonart.com/#sle).
  - 6) Substitutions: See Section 01 6000 - Product Requirements.
- b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
- c. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
- d. Color and Pattern: As selected by Architect from manufacturer's full line.
3. Other Components Thickness: 1/2 inch, minimum.
4. Exposed Edge Treatment: Built up to minimum <> thickness as indicated on drawings; radiused edge.
5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
6. Skirts: As indicated on drawings.

## **2.02 MATERIALS**

- A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
- B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- C. Joint Sealant: Mildew-resistant silicone sealant, clear.

## **2.03 FABRICATION**

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
  1. Join lengths of tops using best method recommended by manufacturer.
  2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
  3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
  1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
  2. Height: 4 inches, unless otherwise indicated.
- C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

### **3.02 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.

### **3.03 INSTALLATION**

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Seal joint between back/end splashes and vertical surfaces.
- C. Securely attach window stools using adhesive. Make flat surfaces level; shim where required.

### **3.04 TOLERANCES**

- A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
- B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
- C. Field Joints: 1/8 inch wide, maximum.

### **3.05 CLEANING**

- A. Clean countertops surfaces thoroughly.

### **3.06 PROTECTION**

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

**END OF SECTION 12 3600**

**SECTION 13 3400  
FABRICATED ENGINEERED STRUCTURES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Freestanding and attached metal canopies.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete footings.
- B. Section 05 1200 - Structural Steel Framing: Canopy connection points at walls.
- C. Division 26 - Electrical: Coordination for conduits and lighting.
- D. Section 33 4000 - Storm Drainage: Connections from downspouts to underground storm pipes.

**1.03 REFERENCE STANDARDS**

- A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- F. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.
- G. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2023.
- H. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2022.
- I. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- J. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.
- K. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs; 2022.
- L. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).
- M. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit product data sheets, including material descriptions and finishes, preparation instructions and recommendations.
- C. Shop Drawings: Prior to commencement of fabrication, submit detailed shop drawings, showing profiles, sections of components, finishes, fastening details, and relationships to adjacent construction.
- D. Design Data: Submit comprehensive structural analysis of design for the specified loads. Stamp and sign calculations by professional engineer.

- E. Certificate of Compliance: Certification that products meet specified design and performance requirements.
- F. Color Selection Samples: Submit color chips or original print of manufacturer's color samples.
- G. Verification Samples: Submit metal samples finished in selected colors.
- H. Manufacturer's Qualification Statement.
- I. Erector's Qualification Statement.
- J. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
- K. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

#### **1.05 QUALITY ASSURANCE**

- A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
  - 1. Comply with applicable code for submission of design calculations as required for acquiring permits.
  - 2. Cooperate with regulatory agency or authorities having jurisdiction (AHJ), and provide data as requested.
- B. Manufacturer Qualifications:
  - 1. Company specializing in the manufacture of products similar to those required for this project.
  - 2. PCI 4000 Certified for the application of powder coated finishes.
- C. Erector Qualifications: Company specializing in performing the work of this section.
  - 1. Not less than three years of documented experience and approved by canopy manufacturer.
- D. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.

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

- A. Deliver materials to project site ready for erection.
- B. Package using methods that prevent damage during shipping and storage on site.
- C. Store materials under cover and elevated above grade.

#### **1.07 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Fabricated Structures: Manufacturer's 10-year warranty against defects in materials and workmanship.
- C. Finishes: Manufacturer's 10-year warranty against peeling or fading in excess of 8 percent of total coated surface.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Metal Canopies:
  - 1. Basis of Design Manufacturer - Canopies, Custom Shade Panels, and Support Structures: Creative Engineered Architectural Systems - CEAS+: [www.ceasplus.com](http://www.ceasplus.com).
  - 2. Substitutions: See Section 01 6000 - Product Requirements.
  - 3. Furnish canopies, custom shade panels, and support structures from a single manufacturer.

## 2.02 METAL CANOPIES

- A. Shop Fabricated Canopy
  - 1. Configuration: Layout and dimensions, column layout, canopy clearance, and roof covering design as indicated on drawings.
    - a. Installation: Freestanding, and face-mounted to building structure with columns at periphery, as indicated on drawings.
    - b. Structural Framing System: Steel, hot-dip galvanized.
    - c. Covering Material: Pre-finished steel roofing panels and perforated aluminum decking, as indicated on drawings.
    - d. Drainage Concept: Water collected on roofing conducted into perimeter gutters and discharged through downspouts into underground storm pipes.
  - 2. Performance Requirements:
    - a. Design and fabricate metal canopy system to resist wind, snow, live, and seismic loads without failure, damage, or permanent deflection in accordance with ASCE 7:
      - 1) Loads: As indicated on drawings.
    - b. Thermal Movement: Design canopy system to accommodate thermal movement caused by ambient temperature range of 120 degrees F and surface temperature range of 180 degrees F without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects on assembly components.

## 2.03 COMPONENTS

- A. Structural Steel Framing:
  - 1. Columns and Beams: ASTM A500/A500M, Grade B, rectangular tubing, sized to suit project design load requirements.
  - 2. Base and Top Plates: ASTM A36/A36M, with pre-drilled bolt holes.
  - 3. Other Structural Steel Members: ASTM A36/A36M.
  - 4. Finish: AAMA 2604, TGCI Polyester powder coat.
    - a. Color: To be selected by Architect from manufacturer's full range.
- B. Bolted Connections: Concealed fasteners.
- C. Covering:
  - 1. Roofing:
    - a. Type: Pre-formed, multi-rib profile, exposed-fastener type.
    - b. Material: Aluminum-zinc alloy-coated steel, 24 gauge minimum, thickness as required to meet project wind loads.
    - c. Finish: AAMA 2605, superior performing organic coating.
    - d. Color:
      - 1) Top Surface: Color as selected by Architect from manufacturer's full range.
      - 2) Bottom Surface: Off-White.
    - e. Fasteners: Gasketed, capped, color to match roofing.
  - 2. Aluminum Decking, Custom Shade Panels:
    - a. Aluminum Plate: ASTM B209/B209M, alloy and temper as recommended by engineer.
    - b. Perforation Pattern: Custom cut perforations, design to be provided by Architect and engineered to meet project wind load requirements.
    - c. Finish: AAMA 2604, high performance organic coating.
      - 1) Color: To be selected by Architect from manufacturer's full range.
- D. Anchor Bolts: ASTM F593 316 alloy, assembled with template for casting into concrete.
  - 1. Provide nuts and washers as required for column leveling and plumbing.
- E. Concrete Footings: Refer to structural drawings and Section 03 3000 for additional requirements.

- F. Exposed Gutters and Downspouts: Aluminum-zinc alloy-coated steel, high performance organic coating finish, color to be selected from manufacturer's full range, sized to provide capacity for drainage of canopy and drainage from building roof areas as indicated on drawings.
- G. Access Panels and Openings: Provide access panels and openings to allow for installation of concealed electrical conduits and junction boxes for mounting of light fixtures.

#### **2.04 SHOP FABRICATION**

- A. Provide a complete system ready for erection at project site.
- B. Shop fabricate to the greatest extent possible; disassemble if necessary for shipping.
- C. Weld steel members in accordance with AWS D1.1/D1.1M.
- D. Fabricate connections for concealed bolt, nut, and washer connectors.

#### **2.05 ACCESSORIES**

- A. Structural Bolts: ASTM F593, 316 alloy.
- B. Fasteners, Non-Structural: Stainless steel, 316 alloy.
- C. Trim, Closure Pieces, and Flashings: Same material, thickness and finish as sheet metal decking; factory-fabricated to required profiles.
- D. Grout: ASTM C1107/C1107M; non-shrinking; premixed compound consisting of non-metallic aggregate, cement, water-reducing and plasticizing agents.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine substrates and site area for conditions that might prevent satisfactory installation.
- B. Verify that foundation, underground storm pipes, electrical utilities, wall connection points, and placed anchors are in correct position.
- C. Verify that bearing surfaces are ready to receive this work.
- D. Do not proceed with installation until all conditions are satisfactory.

#### **3.02 INSTALLATION - FRAMING**

- A. Install in accordance with manufacturer's instructions and approved shop drawings.
- B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation.
- C. Set column base plates with non-shrink grout to achieve full plate bearing.
- D. Fasten columns to anchor bolts.
- E. Do not field cut or alter structural members without approval.

#### **3.03 INSTALLATION - CANOPY COVERING**

- A. Install in accordance with manufacturer's instructions.
- B. Fasten metal roofing and decking to metal support members, aligned level and plumb.
- C. Install fascia, trim, flashing, gutters, and downspouts. Connect downspouts to underground storm pipes.
- D. Separate dissimilar metals using concealed bituminous paint.
- E. Touch-up damaged finish coating using material provided by manufacturer to match original coating.

#### **3.04 TOLERANCES**

- A. Tolerances on steel structural members are set according to AISC construction practices, abided in the factory, and cannot be increased. No field slotting or opening of holes will be allowed. It is therefore essential that contractors conform to the tolerances specified on the installation drawings for anchor bolt or column layout details.

### **3.05 CLEANING**

- A. Clean surfaces of dust and debris; follow manufacturer's cleaning instructions for the finish used.

### **3.06 PROTECTION**

- A. Protect canopy after installation to prevent damage due to other work until Date of Substantial Completion.

**END OF SECTION 13 3400**

**SECTION 21 0000**  
**FIRE PROTECTION**

**210001 GENERAL**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
- B. Contractor shall provide coordination drawings per Division 1.
- C. Fire Protection work shall be performed as outlined in "Information for Bidders".
- D. These specifications and the accompanying fire protection drawings are intended to provide for all labor, materials and equipment necessary for the installation of a complete
  1. Wet-pipe sprinkler systemand accessories including necessary apparatus, valves and fittings hereinafter described or called for on the fire protection drawings accompanying these specifications.
- E. All fire protection work shall be installed in accordance with the following Codes and all Local Ordinances. Codes shall be latest editions approved by the NC Building Code Council with North Carolina amendments. Materials, equipment and workmanship shall be as hereinafter specified.
  1. North Carolina State Building Code
  2. North Carolina State Fire Prevention Code
  3. NFPA 70
  4. NFPA 13
- F. All products used as part of the installation of the fire sprinkler system shall be Underwriter's Laboratories (UL) or Factory Mutual (F.M.) approved as required by NFPA 13.
- G. This contractor shall secure all required permits and inspection fees necessary for this work. Permits may be secured from the Building Inspections Department.
- H. The accompanying drawings are schematic only and are not intended to show all fittings, couplings, hangers, offsets, etc., unless specifically dimensioned. The layout shown on the drawings is a conceptual layout only. This contractor shall provide complete installation drawings for the sprinkler systems defined herein, per the Contract Drawings and these specifications. Provide all adjustments as necessary to conform to the structural conditions, machinery, equipment, work of other contractors and the intent of the drawings, without additional cost to the Owner. Fire protection consultant drawings should not be scaled. Secure dimensions from Architectural drawings. Refer to drawings of other trades and coordinate with other contractors. All equipment shall be installed in accordance with the manufacturer's published installation instructions and diagrams.
- I. The Contractor shall coordinate the exact location of incoming sprinkler riser rough-in with Division 33, Division 22, and all other trades.

**210002 SCOPE OF WORK**

- A. The Contractor shall be required to perform all the following work, in general and provide a complete fire sprinkler system(s) as shown on the plans. This Contractor's scope of work begins at the sprinkler riser rough-in(s) provided by others, approximately one foot above the finished floor. The items in general are to be as follows:
  1. Furnish and install complete wet-pipe sprinkler system as shown on the fire protection drawings and here-in specified.
  2. Sprinkler Contractor is responsible for performing a hydrant flow test. Contractor shall coordinate with and get approval of date, time, and location of flow test from the local Fire Department and local Water Utility. Contractor shall adhere to any requirements for the flow test indicated on the Contract Drawings.

## 210003 LIST OF MATERIALS, FIXTURES AND EQUIPMENT

- A. Sprinkler system design submittal, including shop drawings, hydraulic calculations, and materials, shall be performed by a Professional Engineer registered in the State of North Carolina, or an individual who has Level III or IV certification from the National Institute for Certification in Engineering Technologies (NICET) in Fire Protection Engineering Technology: Water-Based Systems Layout in accordance with NICET 1014.
- B. The Sprinkler Contractor shall obtain written approval from the Engineer/Architect for the use of substitute materials 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 Sprinkler Contractor and not by subcontractors or manufacturer's representative. The Sprinkler Contractor shall submit within ten days following award of contract and written notice to begin the work a complete list of materials proposed for the job. All like items shall be by the same manufacturer. When this list is approved, no further substitutions will be permitted except in unusual or extenuating circumstances. If no list is submitted, the Sprinkler Contractor shall supply materials specified. The Sprinkler Contractor shall review and stamp the submittals as being in accordance with his or her bid and these specifications.
- C. The Sprinkler Contractor shall submit their flow test data prior to starting sprinkler system design.
- D. The Sprinkler Contractor shall submit a set of installation plan drawings to the Architect before any materials, and equipment to be incorporated in the work has been ordered. **FAXED COPIES WILL NOT BE ACCEPTABLE.** Installation plan drawings shall include:
1. Hydraulic design data, including remote area designation(s), and locations of nodes.
  2. Flow test data.
  3. All piping, included mains, cross mains, branches, and armovers with sizes indicated.
  4. Locations of couplings on grooved piping.
  5. Location of Riser(s).
  6. Riser Details.
  7. Hanger Details.
  8. Locations of sprinkler heads.
  9. Sprinkler head legend, indicating the manufacturer and model number of each type of sprinkler head.
  10. Location of backflow preventer.
  11. Location of fire department connection and associated check valve.
  12. Location of backflow preventer test header.
  13. Location of inspector's test connection.
  14. Location of auxiliary drains.
  15. Site diagram indicating water supply piping location, sizes, and hydraulic calculation nodes.
  16. Preparer's NICET Certification ID or Professional Engineer Seal.
  17. Coordination Drawings per Division 1.
- E. The Sprinkler Contractor shall submit a set of hydraulic calculations to the Architect before any materials, and equipment to be incorporated in the work has been ordered. Hydraulic Calculations shall be performed using computer-based software, such as HydraCALC or HASS. **FAXED COPIES WILL NOT BE ACCEPTABLE.** Hydraulic Calculations shall include:
1. Required water density and size of remote area(s), in accordance with NFPA and the Authority Having Jurisdiction.
  2. Pressure and flow required for the system(s) to operate properly (after hose allowance has been added).
  3. Flow test data. Sprinkler Contractor shall reduce the static pressure, residual pressure, and flow by 10% when performing hydraulic calculations, per the AHJ.
  4. Node by node analysis of required pressure, required flow, friction losses, and elevation.

5. Flow vs. pressure curves, indicating that sprinkler system demand curve(s) are sufficiently below flow test curve.
- F. The Sprinkler Contractor shall submit a set of manufacturer's submittal data to the Architect before any materials, and equipment to be incorporated in the work has been ordered. **All sprinkler system components shall be UL listed and/or FM approved as required by NFPA 13.** Shop drawings shall include the name and address of the manufacturer and their catalog numbers and trade names clearly marked. All items shall be referenced to the specifications by **specification paragraph number on an index tab.** One complete set of submittal data shall be manufacturer's original published material. **FAXED COPIES WILL NOT BE ACCEPTABLE.** Approval of materials will be based upon the manufacturer's published ratings. Submit shop drawings and/or catalog data for the following material and equipment:
  1. Sprinkler Heads
  2. Piping, Fittings, and Couplings
  3. Valves
  4. Gauges
  5. Hangers
  6. Riser Check Valve
  7. Flow Switch
  8. Backflow Preventer Test Header
- G. Approval of shop drawings and/or submittal data shall not relieve the Sprinkler Contractor of the responsibility to comply with the requirements and intent of the plans and specifications with regard to dimensions, capacities, quality, quantity, performance characteristics, etc. If data submitted deviates from the contract documents, the Sprinkler Contractor shall point out such deviations in writing and also state reasons for same. All similar items shall insofar as possible be one make and manufacturer. **MANUFACTURER'S MODEL NUMBERS LISTED WITHIN DIVISION 21 SPECIFICATIONS ARE PROVIDED FOR GENERAL INFORMATION ONLY.** Description of product shall take precedence over model numbers.
- H. Prior to submitting equipment information, the Contractor shall field verify all necessary dimensions to ensure that all equipment will fit within designated rooms and/or spaces with proper clearances.
- I. Failure to submit materials, equipment, etc., the Architect shall assume that all items shall be installed as specified.

#### **210004 WORKMANSHIP**

- A. Layout:
  1. Furnish and install all necessary sleeves, inserts, etc., for walls and partitions. Failure to install such items in time to avoid delaying the general contractor shall result in the Contractor doing all cutting and repairing at his or her own expense.
  2. Conceal piping above ceilings. Where piping is installed in areas without ceilings, coordinate with all other exposed items.
  3. Provide sprinkler protection below all obstructions 4'-0" and wider per NFPA 13.
  4. The General Contractor shall paint exposed piping per Division 9 to match surroundings. Sprinkler heads shall not be painted. Any sprinkler head that is painted shall be removed and replaced.
  5. All equipment shall be installed in accordance with manufacturer's installation written instructions.
  6. All equipment shall be installed such that components do not provide a safety hazard to occupants who come within a close proximity.
- B. All equipment and components located on site shall be protected from the weather and damage from construction equipment.
- C. Wet-pipe sprinkler system piping:
  1. Piping shall be installed level, without slope, unless otherwise indicated on Contract Drawings.

- a. Exception: Piping installed immediately below sloped roofs shall match the slope of the roof.
  - b. If sloped piping causes water to be trapped from draining in quantities exceeding 5 gallons, an auxiliary drain shall be provided in an accessible location.
- 2. Run all piping as directly as possible, avoiding unnecessary bends and turns so as not to interfere with proper installation of work of other contractors.
- 3. All piping shall be routed with a minimum clearance of ten (10) feet from any electrical switchboards, electrical panels, panel boards, telephone backboards, or any other energized components.
- 4. Piping shall be concealed in walls, or above ceilings, unless otherwise indicated on Contract Drawings.
  - a. No sprinkler piping shall be covered or concealed until inspected by the Authority Having Jurisdiction, and tested and approved by the Architect.
- 5. Piping shall not be installed underground.
- 6. Sprinkler heads shall be installed in the center of ceiling tiles.
- 7. Sprinkler heads shall be installed on armovers to allow their locations to be adjusted to the center of ceiling tiles.
- 8. Sprinkler mains, cross mains, and branches shall be at least 1-1/4" in diameter and armovers shall be at least 1" in diameter.
- 9. Support horizontal black steel pipe with hangers located every 12 feet for piping 1-1/4" or smaller and every 15 feet for all piping 1-1/2" or larger.
- 10. Armovers longer than 24" shall be supported by hangers per NFPA 13.

#### **210005 CUTTING, PATCHING AND CHASING**

- A. All cutting and patching shall be in accordance with the "General Conditions" of these specifications.

#### **210006 WET-PIPE SPRINKLER SYSTEMS**

- A. Piping:
  - 1. Sprinkler piping 2" and smaller (minimum 1") shall be Schedule 40 threaded black steel, conforming to ASTM A 795 and ANSI/ASTM A 53.
  - 2. Sprinkler piping 2-1/2" and larger shall be Schedule 10 roll grooved black steel, conforming to ASTM A 795 and ASTM A 135.
- B. Fittings:
  - 1. Fittings for threaded black steel piping shall be cast iron threaded fittings.
  - 2. Fittings for grooved black steel piping shall be ductile iron grooved fittings conforming to ASTM A 536. Fittings shall be joined with rigid ductile iron couplings.
- C. Riser:
  - 1. Riser check valve shall have grooved connections and be rated for 250 psi, with upstream and downstream pressure gauges, and main drain valve piped to exterior of the building.
  - 2. Electric vane-type water flow alarm switch shall consist of a U bolt and saddle with non-corrosive insert for mounting to the pipe, a non-corrosive vane and trip stem assembly for detecting waterflow and a retard time delayed switch to prevent false alarms from water surges. Waterflow switch enclosures shall be NEMA 4 rated and shall be held captive by tamper resistant screws. It shall be possible to install an optional cover tamper switch to detect removal of the enclosure. The device shall be listed for pressures up to 450 psi, maximum water surges of 18 fps and alarm activation by 10gpm. Activation shall be accomplished by the continuous flow of water against a non-corrosive paddle attached to a non-corrosive stem operating a field replaceable instantly recycling adjustable retard with a 0-90 second range and visual indication of activation. Expiration of the retard time shall result in the simultaneous operation of two sets of single pole double throw (SPDT) switch contacts rated at 10A, 125VAC and 2A, 30VDC. Each switch contact shall have a separate wiring chamber and separate conduit entrance to comply with the separation of

power limited and non-power limited conductors without the need for special wire or wire methods.

3. Control Valves shall be ductile iron butterfly valves with grooved ends.
4. Alarm bell shall have under dome strikers and operating mechanisms. Gong shall have an operating voltage of 24VDC. Bell shall be surface mounted on exterior of building and have weatherproofed electrical box.

#### **210007 HANGERS:**

- A. Hangers for vertical piping shall be the Riser Clamp design.
- B. Hangers for horizontal piping shall be hanger rings attached to top beam clamps using 3/8" threaded rod. Top beam clamps shall only be attached to the top portion of structural members. All hangers shall permit adequate adjustment after erection while still supporting the load.
- C. Trapeze hangers are allowed only where it is necessary due to the required piping layout and structure.
- D. Trapeze hangers shall attach to the structure using top beam clamps located on both sides of trapeze hanger. Top beam clamps shall only be attached to the top portion of structural members.
- E. Hangers **SHALL NOT** be fastened to joist bridging or roof deck.

#### **210008 VALVES**

- A. Valves not specified elsewhere in Division 21 shall be UL listed and/or FM approved as required by NFPA 13, and shall be listed specifically for fire protection service.
- B. Dielectric unions shall be used to join dissimilar metals.

#### **210009 ACCESS DOORS**

- A. Access doors shall be provided for all valves located behind hard ceilings and in walls to provide access. Access doors shall be a minimum of 24" x 24". Material shall be per division 8 specifications. See Access Doors and Panels 08 3100.

#### **210010 PIPE SLEEVES, PLATES, ESCUTCHEONS, ETC.**

- A. Pipe sleeves shall be standard weight schedule 40 black steel. All sleeves shall be equal to construction thickness except that pipe sleeves passing through floors above grade, shall extend 3/4" above the finished floor. Pipe sleeve sizes shall be sized two pipe sizes larger than piping passing thru the sleeve.
- B. Piping thru non-fire rated walls, floors above slab on grade or ceilings shall have sleeves installed concentric and centered on pipe. Ream all sleeves to prevent cutting of piping. The Contractor shall furnish shop drawings to the general contractor and the Architect showing location, dimensions, and sizes of holes required.
- C. Install escutcheons snug against room finish on all exposed pipe passing through walls, floors above slab on grade or ceilings. Use cup type escutcheons at floors where sleeves extend above finished floors. Escutcheons shall be chrome plated steel with spring clip as by Keeny, Connecticut Stamping and Bending Company of Dearborne.
- D. Core drill openings for all floor openings may be utilized in lieu of sleeved openings. All openings shall be sized two pipe sizes larger than pipe passing thru the opening. All cored openings shall be fireproofed as required and shall be made water tight.
- E. All penetrations in rated floors, firewalls and any other rated separations shall be protected using a through-penetration firestopping method with an "F" rating equivalent to the rating of the membrane being penetrated for particular piping materials used and membrane construction type. Floor penetrations shall additionally have a "T" rating equivalent to the rating of the floor being penetrated. Through-penetration firestop systems shall be installed and tested in accordance with ASTM E814 or UL 1479 with a minimum positive pressure differential 0.01

inch w.g. All openings through horizontal fire separations shall be protected by Metacaulk U.L. Systems or approved U.L. listed system by other manufacturers.

- F. All openings through floors and vertical fire separations shall be protected by combination water seal and fire stops as manufactured by Presealed Systems or approved equal by Proset, or approved equal by Metacaulk or 3M.

**210011 SPRINKLER SYSTEM IDENTIFICATION:**

- A. Each individual riser shall be marked with a metal hydraulic placard containing the following data:
  - 1. Location of area protected by riser.
  - 2. Total number of sprinkler heads connected to riser.
  - 3. Design density and design area, as approved.
  - 4. Required flow rate and pressure at the base of the riser, as approved.
- B. Each Fire Department Connection, Inspector's Test, and Auxiliary Drain shall be clearly labeled with corrosion-resistant metal signage. Signs shall be white with red letters.

**210012 SPRINKLER HEADS**

- A. Sprinkler head types shall be as indicated on the Contract Drawings, and shall be listed for the proposed application.
- B. All sprinkler heads shall be quick response type, unless otherwise indicated on the Contract Drawings.
- C. All sprinkler heads shall be glass bulb type.
- D. Sprinkler heads shall have ordinary temperature classification, unless otherwise indicated on the Contract Drawings, or required by NFPA 13.
- E. K-Factor of sprinkler heads shall be 5.6 or 8.0.
- F. Provide spare sprinkler head cabinet with a spare sprinkler heads of each type installed within the building, as required by NFPA 13. Provide at least one wrench of each type required.

**210013 PROTECTION OF WORK AND EQUIPMENT**

- A. The Contractor shall be responsible for all work damaged by him or her. Any fire sprinkler system work damaged by any other contractor shall be replaced by the Contractor and placed in perfect working condition without extra cost to the Owner. All sprinkler heads, valves, pipe, fittings, and equipment shall be adequately protected before, during and after installation.
- B. The Contractor shall be responsible for all sprinkler heads, valves, pipe, fittings, and equipment at time of final inspection. Any broken items will be replaced by the Contractor at no cost to the owner regardless of by whom the item was broken.

**210014 TESTING**

- A. The Contractor shall notify the Engineer forty-eight (48) hours in advance of all tests. The Contractor shall make all necessary preliminary tests to ensure a functional system, which shall include flushing, testing, and inspection of sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
- B. All tests shall be applied before any work is concealed or covered in any manner.
- C. All tests shall be conducted with regard to safety of all personnel on site.
- D. The Authority Having Jurisdiction shall be alerted to and invited to witness all Division 21 tests.
- E. Preliminary Tests:
  - 1. All sprinkler piping, shall be made tight under a hydrostatic test pressure of 50 psi greater than the required design pressure, or 200 psi, whichever is greater. Hydrostatic test pressure shall be maintained without pressure loss for a minimum of two (2) hours. No caulking of joints will be permitted. Test pressure shall be read from a gauge located at the low elevation point of the system that is under test pressure. Any joint found to leak under this test shall be broken, remade and a new test applied.

2. Waterflow detecting devices, including associated alarm circuits, shall be flow tested using the inspector's test connection. Alarm bell must be audible on premises within five (5) minutes of fully opening inspector's test connection. Each water-operated alarm device shall be tested to verify proper operation.
  3. Each tamper switch shall be tested by operating the associated valve.
  4. Following flushing of the underground piping, a main drain test shall be made to verify the adequacy of the water supply. Static and residual pressures shall be recorded and submitted. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.
  5. Energize circuits to electrical equipment and devices.
  6. Verify that equipment hose threads are same as local fire department equipment.
  7. Main drain valves shall be opened until the system pressure stabilizes.
  8. All control valves shall be fully opened and closed under system water pressure to ensure proper operation.
  9. All alarms, supervisory signals, and trouble signals that are related to the sprinkler system shall be activated and verified.
- F. A final acceptance test shall be conducted, only after all above tests have been successfully conducted and reports have been submitted and approved, in which a technician employed by the installing Sprinkler Contractor shall provide a complete demonstration of the operation of the system. This demonstration shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches, as well as a subsequent main drain test to verify that the control valves are in the open position. The technician shall have a copy of all "as-built" drawings, as well as certificates of previously conducted tests listed above. The sprinkler system installation shall not be considered accepted until as identified problems have been corrected, and the system is successfully retested. It is also required that the test documentation is properly completed and received prior to system acceptance.
- G. Prior to making a request of Beneficial Occupancy the Sprinkler Contractor shall submit written test reports and certificates as required by NFPA 13. Submittals shall include system acceptance forms copyrighted by NFPA which shall bear the NFPA copyright symbol. No other forms shall be considered.
- H. Sprinkler piping system will be considered defective if it does not pass tests and inspections. Replace damaged and malfunctioning controls and equipment, and retest as necessary.
- I. The Contractor shall furnish all necessary equipment, materials and labor to perform the above-specified tests. All equipment and materials shall be in excellent condition.

#### **210015 PLACING IN SERVICE**

- A. The Contractor shall furnish Owner's representative with Contractor's Material and Test Certificate, per NFPA.
- B. The Contractor shall place the entire system in a satisfactory operating condition and shall furnish all assistance and instructions required by the Owner's representative during initial operating period.

#### **210016 ELECTRICAL WIRING**

- A. Equipment connections to alarm systems shall be provided by Fire Alarm Contractor.

#### **210017 OPERATING AND MAINTENANCE MANUAL**

- A. Four (4) complete sets of all operation and maintenance manuals **shall** be delivered by the Contractor to the Owner thru the Architect. The manuals **shall** be installed in 3-ring hard cover heavy duty notebooks with the name of the project and the words "**Operation and Maintenance Manual**" permanently affixed to the **cover** and **spine**. All items for the project shall be separated by identification tabs correlated to the index. The manuals **shall** contain the following items as a minimum:
  1. Index and page number.

2. Certificate of substantial completion.
  3. A summary sheet of warranties with dates noted and a copy of all warranties.
  4. List of subcontractors and suppliers with names, addresses, and phone numbers.
  5. All documented results of preliminary and system acceptance testing.
  6. Complete start-up, operation, and shutdown procedures for each system including sequence of events, locations of switches, emergency procedures, and any other critical items
  7. Lubrication schedules and types of lubricants.
  8. Complete set of Sprinkler Contractor's record drawings and hydraulic calculations.
  9. Equipment summary showing all capacities and ratings (HP, KW, etc.).
  10. Operation manuals, installation manuals, and parts list for all installed equipment.
  11. All submittal data indexed with tabs.
  12. Copy of NFPA 25, edition to match that which is currently enforced by the Authority Having Jurisdiction.
- B. One copy shall be manufacturers original published literature with manufacturers name on all items. **FAXED COPIES WILL NOT BE ACCEPTABLE.**
- C. Contractor shall provide training for the Owner's maintenance personnel covering the operation and maintenance of the sprinkler system.

**210018 AS BUILT DRAWINGS**

- A. The General Contractor and Sprinkler Contractor shall maintain a set of drawings marked up to show the work as installed. Both Contractors shall initial and date all changes to the contract drawings. The Architectural Observer may check this set of documents monthly for compliance. Upon completion of the work, Sprinkler Contractor shall use these as-built drawings to create a set of record drawings which shall be delivered to the Architect.
- B. A printed set of record drawings, along with hydraulic calculations updated as necessary due to field changes, shall be placed within a white PVC tube marked "Fire Sprinkler Shop Drawings" and securely fixed in the first sprinkler riser room.
- C. A second set of printed record drawings shall be provided to the Owner, as well as electronic copies of the record drawings and updated hydraulic calculations in PDF form.

**210019 GUARANTEE**

- A. Guarantee: The Contractor shall guarantee the entire fire sprinkler system subject to the General Conditions of these specifications.

**210020 BIDDING PROCEDURE**

- A. The Contractor shall provide bidding for Alternate Bids in accordance with Division 1. Contractor shall refer to Division 1 for any required unit prices and allowances.

**END OF SECTION**

## SECTION 22 0000

### PLUMBING

#### 220001 GENERAL

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
- B. Contractor shall provide coordination drawings per Division 1.
- C. Instructions to Bidders, General Conditions, Supplementary General Conditions and Division One, Drawings and these Specifications constitute the necessary documents for this part of the work, a copy of same being bound herewith. This contractor shall be bound by these and wherever the word "Architect" shall appear, it shall be understood that this shall include the duly accredited representative of the Architect or Engineer on the project.
- D. Plumbing work shall be performed as outlined in "Information for Bidders".
- E. These specifications and the accompanying plumbing drawings are intended to provide for all labor, materials and equipment necessary for the installation complete of all
  - 1. Plumbing Fixtures
  - 2. Equipment
  - 3. Rough-Ins
  - 4. Waste And Vent System
  - 5. Cold Water System
  - 6. Hot Water System
  - 7. Roof Drainage System
  - 8. Overflow Roof Drainage Systemand accessories including necessary apparatus, valves and fittings hereinafter described or called for on the plumbing drawings accompanying these specifications.
- F. All plumbing work shall be installed in accordance with the following Codes and all Local Ordinances. Materials, equipment and workmanship shall be as hereinafter specified.
  - 1. North Carolina State Plumbing Code
  - 2. ICC A117.1
  - 3. NSF Standard # 61
- G. This contractor shall secure all required permits and inspection fees necessary for this work. Permits may be secured from the Building Inspections Department.
- H. The accompanying drawings are schematic only and are not intended to show all fittings, bolts, connections, offsets, etc., unless specifically dimensioned. Follow drawings as closely as possible, provide all adjustments as necessary to conform to the structural conditions, machinery, equipment, work of other contractors and the intent of the drawings, without additional cost to the Owner. Plumbing drawings should not be scaled. Secure dimensions from Architectural drawings. Refer to drawings of other trades and coordinate with other contractors. All items of equipment shall be installed in accordance with the manufacturer's published installation instructions and diagrams.
- I. The Contractor shall coordinate water and sewer taps and pay all fees in conjunction to provide services as required, for this project.

#### 220002 SCOPE OF WORK

- A. The Contractor shall be required to perform all the following work, in general and provide a complete plumbing system as shown on the plans. The items in general are to be as follows:
  - 1. Furnish and install complete waste and vent system with connections to services as shown on the plumbing drawings and here-in specified.
  - 2. Furnish and install cold water system complete with connections to point as shown on the plumbing drawings and here-in specified.

3. Furnish and install hot water system complete with connections to equipment as shown on the plumbing drawings and here-in specified.
4. Furnish and install roof drainage leader system as shown on the plumbing drawings and here-in specified.
5. Furnish and install overflow roof drainage system as shown on the plumbing drawings and here-in specified.
6. Provide plumbing fixtures and connections to plumbing systems as shown on the plumbing drawings and here-in specified.
7. Provide connections to equipment furnished and installed by General Contractor or Owner as shown on the plumbing drawings and here-in specified.

## **220003 LIST OF MATERIALS, FIXTURES AND EQUIPMENT**

- A. The Plumbing Contractor shall obtain written approval from the Engineer/Architect for the use of substitute materials 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 Plumbing Contractor and not by subcontractors or manufacturer's representative. The Plumbing Contractor shall submit within ten days following award of contract and written notice to begin the work a complete list of materials proposed for the job. All like items shall be by the same manufacturer. When this list 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. *Contractor should note that all items specified in section 220000 shall be submitted independently of other 220000 series sections.* The Plumbing Contractor shall review and stamp the submittals as being in accordance with his bid and these specifications. **Private labeled materials are not acceptable.**
- B. The Plumbing Contractor shall submit shop drawings to the Architect after award of the contract, and before any materials, fixtures, and equipment to be incorporated in the work has been ordered. Shop drawings shall include the name and address of the manufacturer and their catalog numbers and trade names clearly marked. All items shall be referenced to the plans and specifications by **fixture designation or specification paragraph number on an index tab.** One complete set of submittal data shall be manufacturer's original published material. **FAXED COPIES WILL NOT BE ACCEPTABLE.** Approval of materials will be based upon the manufacturer's published ratings. Submit shop drawings and/or catalog data for the following material and equipment:
  1. Waste Piping, Fittings and Couplings
  2. Water Piping, Fittings and Equipment
  3. Roof Drainage Piping, Fittings and Couplings
  4. Overflow Roof Drainage Piping, Fittings and Couplings
  5. Circulator Pumps
  6. Cleanouts and Access Doors
  7. Valves
  8. Insulation
  9. Hangers
  10. U. L. penetration systems
  11. Pipe Markers
  12. Fixtures
  13. Coordination Drawings per Division 1.
- C. Approval of shop drawings and/or submittal data shall not relieve the Plumbing Contractor of the responsibility to comply with the requirements and intent of the plans and specifications with regard to dimensions, capacities, quality, quantity, performance characteristics, etc. If data submitted deviates from the contract documents, the Plumbing Contractor shall point out such deviations in writing and also state reasons for same. All similar items shall insofar as possible be one make and manufacturer.
- D. Where any special make, fixture or materials are specified by plate number, trademark or name, deliver to the building with original labels or other identification marks placed thereon by the

manufacturer and do not remove until inspected and approved by the Architect. Similar and equal materials and equipment by other manufacturers will be acceptable, subject to approval.

- E. Failure to submit materials, equipment, fixtures, etc., in the time period specified above, the Architect shall assume that all items shall be installed as specified.

## **220004 WORKMANSHIP**

A. Layout:

1. Drawings indicate general locations of fixtures. Secure exact location from Architectural plans before proceeding with work.
2. Furnish and install all necessary sleeves, inserts, bolts, etc., for concrete floor slabs, roof, walls, and partitions. Failure to install such items in time to avoid delaying the general contractor shall result in the Contractor doing all cutting and repairing at his own expense.
3. Sleeves as here-in-after specified shall be installed on all through the floor piping above slab on grade except water closet rough-ins. Water closet rough-ins shall be cast in place. Core drilling of slabs shall be sealed with approved fire retardant caulking and sealed watertight.
4. All equipment shall be installed in accordance with manufacturer's written installation instructions.

B. Drainage, Waste and Vent Piping:

1. Grade all sanitary waste lines 2" and smaller 1/4" per foot.
2. Grade all sanitary waste lines 3" and larger 1/4" per foot, where possible, 1/8" per foot minimum.
3. All underground piping shall be graded by the use of a laser beam alignment system.
4. All floor drains shall be set 1/2 inch below the room finished floor perimeter and the entire floor sloped to the floor drain.
5. Run all piping as directly as possible, avoiding unnecessary bends and turns so as not to interfere with proper installation of work of other contractors.
6. All PVC-DWV piping shall be protected by a cast iron sleeve under the following condition with a sleeve as follows:
  - a. Piping passing thru foundation walls: Sleeve shall extend 6 inches beyond wall footing on both sides.
  - b. Piping passing thru CMU walls: Sleeve shall extend 6 inches beyond wall footing on both sides.
  - c. Piping passing below a footing: Per Contract Drawings.
7. Provide removable caps for cleanouts with at least six threads engaged. Provide cleanouts at foot of waste and drainage stacks, all changes in direction of horizontal lines more than 135 degrees, in straight lines at intervals not exceeding 100-feet and anywhere additionally noted on the drawings.
8. Support horizontal cast iron soil pipe with a minimum of one hanger for each pipe length. Location close to hub or no-hub connector.
9. Run all horizontal and vertical piping true and plumb to building structure and connect all piping with 'Y' branches and 1/8 or 1/16 bends.
10. Tapped tees and crosses will not be permitted. Tapped sanitary tees and crosses shall be used.
11. No soil, waste, or vent piping shall be covered or concealed, until tested and approved by the Architect.
12. Conceal all soil and vent piping. Vents shall be tied together as shown with minimum number of vents extending through roof. All vents extended through the roof shall be a minimum of 12" above roof level.
13. All PVC-DWV and PVC drainage lines shall be maintained under a continuous head of 10 foot until after all concrete slabs are poured and/or all heavy equipment has been removed from the site.
14. All PVC-DWV and PVC drainage lines shall be bedded per the manufacturer's recommendations and shall be maintained under a continuous head of 10-feet until after

all concrete slabs are poured and/or all heavy equipment has been removed from the site. Contractor shall be responsible for the protection of the piping system at all times including freezing weather.

C. Water System:

1. Conceal water supply piping in walls, below floor or above ceiling except where exposed for connections to fixtures. Install and secure all piping as walls are built. Wedging of piping will not be permitted. **All piping shall be isolated from mortar.**
2. All water piping shall be routed with a minimum clearance of ten (10) feet from any electrical panels, electrical switchboards, panel boards, telephone backboards, or any other energized components.
3. Arrange all pipes to freely drain through a ball valve when water is cut off. All branch valves shall be installed adjacent to the water piping main.
4. All supplies to fixtures shall have individual stop valves.
5. Provide water hammer shock arrestors as required to prevent water hammer. Arresters shall be A.S.S.E. Standards Number 1010 certified. Arresters shall be installed in accordance with manufacturer's published recommendations. Air chambers are not acceptable. Water hammer shock arrestors shall be as manufactured by Precision Plumbing Products, Inc. or approved equal by Zurn, Josam, J.R. Smith, or Sioux Chief.
6. All exposed piping to fixtures shall be chrome plated installed true and plumb.
7. Insulate all water piping inside the building as hereinafter specified.
8. All tees shall be installed such that the flow shall be straight thru the tee and/or out the side. Tees **shall not** be installed where the flow is into the side and out of both ends of the tee (bullhead tee). Bullhead tees installations are not acceptable and shall not be used.
9. Extend water lines to water mains where shown on the plans.
10. Terminate cold water line 5-feet outside building. Connection at this point will be by the General Contractor.

D. Roof Drainage Piping:

1. Roof drains shall be provided by the Plumbing Contractor and installed where shown on the architectural roof plan by the General Contractor. The Plumbing Contractor shall connect to these roof drains and install the collector and leader system as shown on the plans.
2. Grade all horizontal leaders with slopes as shown on the drawings.
3. All PVC-DWV and PVC drainage lines shall be maintained under a continuous head of 10 foot until after all concrete slabs are poured and/or all heavy equipment has been removed from the site.

E. Overflow Roof Drainage System:

1. Overflow roof drains shall be provided by the Plumbing Contractor and installed where shown on the architectural roof plan by the General Contractor. The Plumbing Contractor shall connect to these roof drains and install the collector and leader system as shown on the plans.
2. Grade all horizontal piping with slopes as shown on the drawings.
3. Terminate piping discharge where shown on the drawings.

F. Insulation:

1. All pipe insulation joints shall be sealed to maintain integrity of the vapor jacket and shall pass thru all sleeves unbroken except for fire stops.
2. Pipe insulation at all fire separations shall be butted tightly to the firewall or to the floor after fire stop material has been installed.

**220005 CUTTING, PATCHING AND CHASING**

- A. All cutting and patching shall be in accordance with the "General Conditions" of these specifications.

**220006 EXCAVATION, TRENCHING AND BACKFILLING**

- A. All excavation, trenching and backfilling shall be in accordance with Division 31 of these specifications.

**220007 WASTE & VENT SYSTEMS**

- A. Piping:
  - 1. Waste and vent piping shall be schedule 40 PVC-DWV solid wall piping conforming to ASTM D-2665-68 and C.S. 272-65 with NSF seal.
- B. Fittings:
  - 1. Fittings for PVC-DWV piping shall be PVC-DWV fittings conforming to piping specifications.
- C. Joints:
  - 1. Joints for PVC-DWV piping shall be made using the piping manufacturer's approved solvent cement.
  - 2. All threaded piping shall be made up using pipe joint compound or Teflon Tape applied to the male thread of the pipe.
  - 3. Flashing of plumbing vents will be provided by the General Contractor.

**220008 HOT AND COLD WATER SYSTEMS**

- A. Water Piping:
  - 1. Water piping 2-1/2" and smaller, below grade, shall be type 'K' soft copper conforming to ASTM B-88.
  - 2. Water piping 3" and larger, below grade, shall be type 'K' hard copper conforming to ASTM B-88.
  - 3. Water piping 4" and smaller above grade inside the building shall be Type 'L' hard copper conforming to ASTM B-88.
- B. Fittings:
  - 1. Fittings for copper piping shall be wrought copper, solder joint fittings conforming to ANSI B 16.22.
  - 2. Fittings for copper piping 2" and smaller may be press fittings conforming to ASME B16.51 and performance criteria of IAPMO PS 117.
- C. Joints:
  - 1. All copper piping joints shall be made in accordance with ASTM B828 using solder with a minimum melting point of 410 degrees Fahrenheit. Solder shall conform to ASTM B32. Flux shall conform to ASTM B813. Both solder and flux shall have a composition containing less than 0.2% lead.
  - 2. Press fitting joints shall be made using the press fitting manufacturer's tools and per manufacturer's instructions.
- D. Backflow Preventer:
  - 1. Backflow preventer shall be lead-free double check valve design, non-health hazard, with strainer, test valves, gate valve on inlet and discharge, inlet and outlet pressure gauges, designed to meet AWWA C-510, ASSE 1015. Unit shall be size as shown on the drawings and be manufactured by Watts LF007S or approved equal by Wilkins, Febco, or Conbraco.
- E. Expansion Tank:
  - 1. Expansion tank shall be diaphragm design constructed of welded steel and shall bear the ASME and National Board Stamp for 150 pounds working pressure and 200° F. operating temperature. Fittings shall include test cocks, hose bibb drain and air control fitting. Tank and fittings shall be as manufactured by Amtrol, Bell and Gossett, Thrush or Taco.
- F. Thermometers and Gauges:
  - 1. Thermometers shall be metallic element type with 3" dial, Type 304 stainless steel case, accuracy range of 1%, black markings on white face, and designed for variable angle mounting. Thermometers range shall be such that the operating temperature shall be in

- the middle range for the dial. Thermometers shall be installed in a thermometer well and shall be Weiss Model 3VBM Series or approved equal by Omega or Tel-Tru Mfg. Co.
2. Pressure gauges shall be non-filled with 4" face, 1/4" NPT lower connection with operating range in middle portion of the dial, accuracy range of 1%, and black markings on white face. Pressure gauges shall be installed with lever handle gauge cocks. Pressure gauges shall be Weiss Model 4PG-1 or approved equal by Omega or Tel-Tru Mfg. Co.

## **220009 ROOF DRAINAGE SYSTEM**

- A. Piping:
  1. Roof drain leaders below grade or slab on grade shall be Schedule 40 PVC-DWV solid wall, conforming to ASTM D-2665.
  2. Roof drain leaders above grade shall be hubless cast iron piping conforming to C.I.S.P.I. Standards 301 and shall carry country of origin, manufacturer's name or manufacturer's registered trade-mark.
- B. Fittings:
  1. Fittings for roof drain leaders below grade shall be Schedule 40 PVC-DWV conforming to ASTM D-2665.
  2. Fittings for hubless cast iron roof drain leaders shall be the sanitary drainage pattern cast iron conforming to ASTM A-888 and shall be marked with the Cast Iron Soil Pipe Institute symbol cast into the fitting
  3. Fittings for roof drainage piping shall be of the sanitary drainage pattern and conforming to piping specification.
- C. Joints:
  1. Joints for PVC-DWV piping shall be made using manufacturer's approved solvent cement.
  2. Joints for hubless cast iron piping shall be made using heavy duty no hub couplings comprised of elastomeric gasket conforming to ASTM C 564 housed inside a 304 stainless steel corrugated shield. Couplings shall have no less than 4 stainless steel clamping bands each. Clamping bands shall have stainless steel bolts torqued to manufacturer's specifications. The entire coupling shall be corrosion resistant and conform to ASTM C 1540.
- D. Drains:
  1. Primary roof drains shall be large sump body coated cast iron drains with galvanized cast iron domes, adjustable extension, combination flashing device/gravel guard, static extension and top set deck plate. Drains shall be Zurn ZC-100-DP-E or approved equal by Josam, J. R Smith, Wade or Watts. Height of static extension shall be as shown on architectural drawings. No hub outlet shall be sized as shown on the drawings.

## **220010 OVERFLOW ROOF DRAINAGE SYSTEM**

- A. Piping:
  1. Overflow roof drain leaders above grade shall be No hub cast iron piping conforming to C.I.S.P.I. Standards 301 and shall carry country of origin, manufacturer's name or manufacturer's registered trade-mark.
- B. Fittings:
  1. Fittings for cast iron overflow roof drain leaders shall be the sanitary drainage pattern conforming to ASTM A-74 and shall be marked with the Cast Iron Soil Pipe Institute symbol cast into the fitting.
- C. Joints:
  1. Joints for hubless cast iron piping shall be made using neoprene gasket and stainless steel clamping band conforming to C.I.S.P.I. Standards 301. Bands shall be same manufacturer as piping and shall carry the NSF Logo.
- D. Termination:
  1. Overflow roof drains shall terminate with a nickel bronze downspout nozzle. Downspout nozzle shall be provided with manufacturer's stainless steel screen. Screen shall be

secured in place. Downspout nozzle shall be Zurn ZANB-SS series or approve equal by Josam, Wade or J. R. Smith.

E. Drains:

1. Overflow roof drains shall be large sump body coated cast iron drains with galvanized cast iron domes, adjustable extension, combination flashing device/gravel guard, static extension, internal water dam to provide not in excess of 4" height over main roof drain and top set deck plate. Drains shall be Zurn ZC-100-DP-E or approved equal by Josam, J. R. Smith, Wade or Watts. Height of static extension shall be as shown on architectural drawings. No hub outlet shall be sized as shown on the drawings.

**220011 HOT WATER CIRCULATOR**

- A. Circulator shall have capacity as shown on drawings and shall be specifically designed for domestic hot water service.
- B. Circulator shall have lead-free bronze body and flanges with lead-free impeller; circulator motor shall be rubber mounted and shall be equipped with overload protection. Circulator shall be direct connected to motor. Circulator shall be Taco, B&G, or Grundfos with capacity as noted on the drawings.
- C. Circulator shall be supported by appropriate hangers to avoid piping strain. Circulators shall be mounted horizontally.

**220012 CLEANOUTS AND ACCESS DOORS**

- A. Cleanouts shall be the same diameter as the pipe they are connected to. If the pipe is greater than 4" in diameter, the cleanout shall be 4".
- B. Cleanouts installed in walls or pipe chases shall be installed using cast iron cleanout tee with cast bronze plug, stainless steel cover with countersunk stainless steel vandalproof securing screw. Cleanouts shall be Zurn ZS-1468, Josam 58600-PLG, or J. R. Smith 4472.
- C. Cleanouts installed in floors and walks shall have adjustable cast iron body with cast brass plug, lead seal and round nickel bronze top with watertight gasketed cover. Cleanouts shall be Zurn ZN-1400, or approved equal by Josam or J. R. Smith.
- D. Cleanouts installed outside the building and flush with grade shall be installed flush with 24" x 24" x 6" thick concrete pad. Cleanouts plugs shall be ABS with recessed head. Cleanouts shall be Josam 57000-X-LT, Zurn Z-1403-BP-NL, or J. R. Smith 4293 Series.
- E. Provide owner with tool(s) to allow for cleanout caps to be removed.
- F. Access doors shall be provided for all valves and shock arrestors located behind hard ceilings and in walls to provide access. Ceiling access doors shall be a minimum of 24" x 24". Material shall be per division 8 specifications. See Access Doors and Panels 08 3100.

**220013 VALVES**

- A. Valves shall be installed at all points noted on the plans by standard symbols or as required by best general practice for proper control and operation of the system. All valves shall be identified with 1" diameter, 19 gauge, polished brass identification tags with a number and valve service indicated. Provide a valve chart listing all valves with size and service framed and mounted under glass in the main mechanical room. Provide a self-sticking 1/2" diameter dot on lay-in ceiling grid at all valve locations. Red dot for domestic hot water supply and return, Blue for cold water.
- B. Check valves 2 inch and small shall be Class 125, lead free design cast bronze body with threaded ends.
- C. Check valves 2-1/2 inch and larger shall be Class 125, cast iron body with flanged ends.
- D. Domestic cold and hot water system valves 1-1/4 inch and smaller shall be lead free design cast bronze body, full ported, soldered end ball valves rated for Class 150, 200 WOG service.
- E. Domestic cold and hot water system valves 1-1/2 inch and 2 inch shall be lead free design cast bronze body, full ported, threaded end ball valves rated for Class 150, 200 WOG service. Valves shall be provided with stem extensions for insulation thickness specified.

- F. Domestic cold and hot water system valves 2-1/2 inch and larger shall be flanged end, iron body ball valves rated for Class 150, 200 WOG service. Valves shall be provided with stem extensions for insulation thickness specified.
- G. Solenoid valves shall be lead free design with threaded ends and shall be normally closed. Solenoid valves shall be designed to open when 120 VAC is applied. Solenoid valves shall be hard-wired.

#### **220014 PIPE INSULATION**

- A. All plumbing pipe insulation systems shall be installed as a subcontract to the Plumbing contract. All plumbing pipe insulation systems, including jacketing, coverings, adhesives when used, shall have a flame spread rating not exceeding twenty-five (25) and a smoke development rating not exceeding fifty (50) when the insulation assembly is tested as a composite. Fibrous glass pipe insulation shall be pre-molded with a thermal conductivity of 0.24BTU/in/hr/ft<sup>2</sup> at 100°F.
  - 1. Insulate all cold water piping above grade with 1" thick pre-molded fibrous glass pipe insulation with self-sealing fire retardant vapor barrier jacket.
  - 2. Insulate all hot water piping, 1-1/2" and smaller, above grade with 1" thick pre-molded fibrous glass pipe insulation with self-sealing fire retardant jacket.
  - 3. Insulate all hot water piping, 2" and larger, above grade with 1-1/2" thick pre-molded fibrous glass pipe insulation with self-sealing fire retardant jacket.
  - 4. Insulate all copper water piping below grade or slab on grade with 1/2" thick pre-molded closed cellular plastic foam pipe insulation.
  - 5. Insulate all hot water return piping with 1" thick fibrous pre-molded glass pipe insulation with self-sealing fire retardant jacket.
  - 6. All drain bodies receiving rain water shall be insulated with 1" thick insulating cement insulation.
  - 7. All roof drain leaders, horizontal and vertical, above slab on grade shall be insulated with 1" thick pre-molded fibrous glass pipe insulation with self-sealing fire retardant vapor barrier jacket.
  - 8. All overflow roof drain leaders, horizontal and vertical, above slab on grade shall be insulated with 1" thick pre-molded fibrous glass pipe insulation with self-sealing fire retardant vapor barrier jacket.
  - 9. Rigid pipe insulation inserts shall be provided for all insulated piping 2" and larger.
- B. Exposed pre-molded pipe insulation in finished areas and mechanical rooms shall be finished with factory jacket neatly pasted in place and left ready for painting as specified hereinafter.
- C. All pipe insulation for pipe fittings shall be pre-molded to fit fittings and shall be enclosed under pre-molded PVC fitting jacket.
- D. All insulated piping exposed to the weather shall be protected with color coded 30 mil PVC jacket cemented in place with PVC fitting covers. Color coding shall be in accordance with ANSI standards.
- E. Plumbing piping located in CMU walls shall be insulated with closed cellular foam insulation with thicknesses as specified above. Foam insulation thermal properties shall match or exceed the specified thermal insulation properties for the intended usage. Insulation shall be secured with insulation manufacturer's approved tape. All copper piping penetrating CMU walls, shall have continuous insulation through penetration. Copper piping shall not come into direct contact with CMU or mortar.
- F. Contractor **may request** that closed cellular foam insulation be used on insulated piping when the building structure is not "dried in" to protect fibrous glass insulation from getting wet. Foam insulation thermal properties shall match or exceed the specified thermal insulation properties for the intended usage. Insulation shall be secured with 16 gauge copper wire at 16 inch centers.

#### **220015 HANGERS**

- A. Hangers for vertical piping shall be the Riser Clamp design and shall conform to MSS SP-58, Types 1 through 58.

- B. Hangers for horizontal piping shall be the Clevis type and shall conform to MSS SP-58, Types 1 through 58.
- C. **Hangers for insulated piping shall extend around the insulation.** Provide 16 gage galvanized steel insulation protection saddles 12" long at each hanger on all insulated lines. Insulation Shields shall cover lower 180 degrees of pipe in the case of clevis hangers, and entire circumference of pipe in the case of trapeze hangers or clamps.
- D. Hangers shall be spaced per the NC State Plumbing Code in accordance with the piping material.
- E. A hanger shall be provided within one (1) foot of each bend in horizontal piping. Vertical piping shall be supported at each floor or at intervals not exceeding ten (10) feet. Support cast iron soil pipe to each joint.
- F. For piping 4" in diameter and larger, rigid support sway bracing shall be provided at changes in direction greater than 45 degrees.
- G. Hangers shall be fastened by means of threaded rods to steel beam clamps, center of bar joist, center of trusses, etc. All hangers shall permit adequate adjustment after erection while still supporting the load. All hanger rods attached to bar joist and trusses shall be install between bottom or top cords of the structural member. Structural members to span from building structure to structure shall be provided by the Contractor.
- H. Hangers SHALL NOT be fastened to joist bridging or roof deck.
- I. Hangers shall only be hung with drilling into the slab with "drop-in" hangers with the approval of the Structural Engineer of record and the Mechanical Engineer of record with complete dead and operating load information provided for each location. Loading information shall be provided by the Plumbing Contractor.
- J. Piping supported on a trapeze hanger shall be secured to the trapeze hanger by means of a pipe clamp around the pipe insulation and insulation saddle. Piping not receiving insulation shall be secured by a pipe clamp and isolated by an isolation cushion.
- K. Piping supported from the floor shall be supported using a base plate securely anchored to the floor and be equipped with riser and pipe clamp. Pipe clamp shall extend around insulation. Riser shall be a minimum of one inch. Horizontal piping above the floor shall be anchored securely in clamp and rest on a manufactured pipe saddle that extends around the full circumference insulation. Locations where piping is to be supported from the floor shall be approved by EOR and architect before drilling into floor.

**220016 PIPE SLEEVES, PLATES, ESCUTCHEONS, ETC.**

- A. Pipe sleeves shall be standard weight schedule 40 black steel above slab on grade or cast iron below slab on grade. All sleeves shall be equal to construction thickness except that pipe sleeves passing through floors, other than slab on grade, shall extend 3/4" above the finished floor. Pipe sleeve sizes shall be sized two pipe sizes larger than piping passing thru the sleeve.
- B. Piping thru non-fire rated walls, floors above slab on grade or ceilings, piping passing through foundation walls, and piping installed below structural footings shall have sleeves installed concentric and centered on pipe. Ream all sleeves to prevent cutting of piping. The Contractor shall furnish shop drawings to the general contractor and the Architect showing location, dimensions, and sizes of holes required. Sleeves on piping passing through foundation walls shall extend 6" beyond wall footing on both sides. Sleeves on piping installed below structural footings shall extend beyond footing as indicated on contract drawings.
- C. Install escutcheons snug against room finish on all exposed pipe passing through walls, floors above slab on grade or ceilings. Use cup type escutcheons at floors where sleeves extend above finished floors. Escutcheons shall be chrome plated steel with spring clip.
- D. Sleeves for insulated piping shall be large enough to allow the insulation to pass thru sleeve unbroken.

- E. Core drill openings for all floor openings may be utilized in lieu of sleeved openings. All openings shall be sized two pipe sizes larger than pipe passing thru the opening. All cored openings shall be fireproofed as required and shall be made water tight.
- F. All penetrations in rated floors, firewalls and any other rated separations shall be protected using a through-penetration firestopping method with an "F" rating equivalent to the rating of the membrane being penetrated for particular piping materials used and membrane construction type. Floor penetrations shall additionally have a "T" rating equivalent to the rating of the floor being penetrated. Through-penetration firestop systems shall be installed and tested in accordance with ASTM E814 or UL 1479 with a minimum positive pressure differential 0.01 inch w.g. All openings through horizontal fire separations shall be protected by Metacaulk U.L. Systems or approved U.L. listed system by other manufacturers.
- G. All openings through floors and vertical fire separations shall be protected by combination water seal and fire stops as manufactured by HoldRite, or approved equal by Proset, Metacaulk, or 3M.

#### **220017 PLUMBING SYSTEM IDENTIFICATION**

- A. All piping in the building shall be identified by snap-on pipe markers or secured with two zip ties. Markers shall have ANSI colored letters at ANSI height on ANSI colored background with flow arrows and shall be located at 10' on center along pipeline, at each tee branch and at each floor/wall penetration, both sides. A pipe marker shall be located adjacent to each valve. Pipe identification markers shall comply with ANSI A13.1 and be Custom MS-790 as manufactured by Marketing Service Incorporated or approved equal Steton, Emed or DuraLabel. Stenciling of piping and/or insulation is not acceptable. Wording on markers shall be as follows where more stringent than ANSI Standards:
  - 1. Cold Water
  - 2. Hot Water
  - 3. Hot Water Return
  - 4. Roof drain
  - 5. Overflow roof drain
- B. Engraved plastic laminate signs for listed plumbing equipment shall be 1/16 inch thick and be secured with self-tapping stainless steel screws. Plastic laminate face color shall be red for all emergency applications and black for all other uses. Letter color shall be white. Signage for all equipment, etc., shall show equipment or service identification, capacity, final date of acceptance for equipment item and warranty information. Signage shall be provided for the following items:
  - 1. Water Heaters
  - 2. Circulator pumps

#### **220018 PROTECTION OF WORK AND EQUIPMENT**

- A. It is imperative that waste and vent lines not be filled with concrete, concrete grindings, sand, gravel, or other foreign matter. Under no circumstances shall any line be left open while the Contractor's workers are not on the job site.
- B. Plug each opening of waste and vent lines the same day it is installed with test plug securely held in place.
- C. All floor drains, floor sinks, and hub drains shall be covered immediately after installation.
- D. The Contractor shall be responsible for all work damaged by him/her. Any plumbing work damaged by any other contractor shall be replaced by the Contractor and placed in perfect working condition without extra cost to the Owner. All fixtures and fittings shall be adequately protected before, during and after installation.
- E. The Contractor shall be responsible for all plumbing fixtures at time of final inspection. Any broken fixtures will be replaced by the Contractor at no cost to the owner regardless of by whom the fixture was broken.

**220019 TESTING**

- A. The Contractor shall notify the Engineer forty-eight (48) hours in advance of all tests. The Contractor shall make all necessary preliminary tests to insure a tight system. Any joint found to leak under test shall be broken, cleaned and remade.
- B. All tests shall be applied before any work is concealed or covered in any manner.
- C. All sanitary waste and vent piping shall be tested in the following manner: Plug all openings and fill entire waste and vent system to overflow with water and sustain a constant level for a minimum period of three (3) hours. All portions of each floor system shall be tested under a minimum of a 10-foot head including roof vent terminal.
- D. All water piping, hot and cold shall be made tight under a hydrostatic test pressure of 150-lbs. per square inch and maintained without pressure loss for a minimum of four (4) hours. No caulking of joints will be permitted. Any joint found to leak under this test shall be broken, remade and a new test applied. Water hammer shock arrestors shall be installed after testing is complete.
- E. All backflow preventers shall be tested and certified by an approved and licensed backflow prevention company.
- F. The roof drain piping system shall be tested in the following manner: Plug pipe outlet and fill entire under floor system with water under a 10-foot head above finished floor and sustain a constant level for a minimum period of three (3) hours. All piping above the lowest floor level shall be tested from a test tee installed at that level with the entire system filled with water into drain body and sustain the constant level for a period of three (3) hours.
- G. The overflow roof drainage piping system shall be tested in the following manner: Each joint in piping system shall be tested under a minimum of a 10-foot water column for a one hour period without loss of water.
- H. The Contractor shall furnish all necessary equipment, materials and labor to perform the above-specified tests.

**220020 STERILIZATION**

- A. All new water piping shall be charged with a chlorine solution containing not less than 50-ppm available chlorine. The solution shall remain in the piping for a minimum period of 6 hours, during which time valves shall be opened and closed to permit a small flow of the solution. At the end of the six (6) hours, the solution shall be tested and must contain a residual of at least 5 to 10 ppm chlorine. The system shall then be drained and flushed to provide satisfactory potable water before final connection is made to the existing distribution system.
- B. The Contractor shall contract with an independent Testing Laboratory for a certification letter that the system sterilization meets or exceeds standards for potable water.

**220021 PLACING IN SERVICE**

- A. Upon completion of the entire system installation, the entire system and all equipment shall be tested by actual operation to provide that it will function as intended.
- B. The Contractor shall flush all waste piping prior to final connection to existing system, to ensure that no foreign materials are in these lines, and that a continuous flow of water and waste can be affected.
- C. The Contractor shall flush all water piping prior to the connection of flush valves, mixing valves, and faucet aerators to provide a clean and operational water system.
- D. The Contractor shall place the entire system in a satisfactory operating condition and shall furnish all assistance and instructions required by the Owner's representative during initial operating period. The Contractor shall acquaint the Owner's representative with the special parts required for the operation of the flush valves furnished and installed on the project.
- E. It is the Contractor's responsibility to turn over to the owner all fixtures and floor drains in a clean condition.

## **220022 PAINTING**

- A. The Contractor should note that plumbing piping may be exposed in various areas. The contractor should specifically note that all exposed cast iron piping be uncoated.
- B. All exposed plumbing pipe and plumbing pipe insulation in areas other than mechanical rooms shall be left clean and free from oil ready for painting by the General Contractor. All finished painting will be by the General Contractor with colors to match the surrounding areas.
- C. All plumbing equipment pads shall be painted yellow.

## **220023 ELECTRICAL WIRING**

- A. The Electrical Contractor shall furnish and install all disconnects and motor starters and circuitry. Plumbing Contractor shall make all final electrical connections to equipment provided under Division 22. See Electrical Drawings.
  - 1. EXCEPTION: Plumbing Contractor shall provide Aquastat(s) as indicated on Contract Drawings and in "CONTROLS" section of Division 22 specifications. The Plumbing Contractor shall be responsible for Aquastat wiring connections.

## **220024 CONTROLS**

- A. General:
  - 1. Circulator Pump Time Clock: The Plumbing Contractor shall provide a 120-volt, 24-hour, 7-day programmable time clock, and wire the time clock to the hot water circulation pump. Time clock shall be located in the same room as the circulation pump.
  - 2. Exterior Faucet Time Clock: The Plumbing Contractor shall also provide a 120-volt, 24-hour, 7-day programmable time clock in a lockable NEMA 4X enclosure, mounted near the exterior sink where shown on the Contract Drawings to control the water flow to the exterior sink faucets. Exterior faucet time clock shall have manual push button override. Associated solenoid valves shall be normally closed and provided by Division 22.
  - 3. All electric wiring in connection with the temperature controls and all interlock wiring shall be furnished under this section of the specifications. The wiring shall be installed by licensed electricians employed by Contractor in strict accordance with all local, State, and National Codes. All control and interlock wiring whether line or low voltage shall be run in EMT conduit or as specified under the electrical section of these specifications. Installation of all concealed conduit shall be coordinated with contractor for general construction so it may be installed before slabs are poured or walls are erected.
  - 4. The control diagrams indicated on the drawings and specified herein show the intended sequences of operation of the various control systems and shall be followed as closely as practicable.
- B. Temperature Sensing Devices:
  - 1. Immersed bulb thermostat shall have an adjustable range and be mounted in the hot water storage tank and be set to maintain a tank temperature of 140°F.
  - 2. Strap-on Aquastat shall have an adjustable range and be mounted directly on the building hot water recirculating line. Aquastat shall be set to 135°F.
  - 3. Each water heater shall be equipped with an integral adjustable thermostat.
- C. Sequence of Operation:
  - 1. Circulator Pump:
    - a. The aquastat shall energize the power to the circulator pump wiring circuit when temperature reaches set point during hours of operation set by the programmable time clock.
    - b. The programmable time clock shall energize the power to the circulator pump wiring circuit. Note: Plumbing contractor shall program time clock per owner's designated hours of operation. Coordinate programming with owner. Provide owner with time clock programming training.
  - 2. Exterior Faucets:
    - a. The programmable time clock shall energize the power to the solenoid valves installed on the hot and cold water branches of the exterior sink faucets, forcing them open

during designated hours of operation. Note: Plumbing contractor shall program time clock per owner's designated hours of operation. Coordinate programming with owner. Provide owner with time clock programming training.

- b. Manual push button on programmable time clock shall energize/de-energize the power to the solenoid valves installed on the hot and cold water branches of the exterior sink faucets, forcing them open or close depending on the user's preference. The valves shall open and close upon the next pre-programmed time interval.

D. Instructions and Diagrams:

- 1. The Contractor shall provide to the owner a complete instruction manual covering the function and operation of all control components. The manual shall also contain a schematic drawing of each control system properly marked and keyed with the equipment list to identify each item of control equipment.
- 2. The Contractor shall also provide a complete schematic control diagram framed under glass and mounted on the wall in the equipment room.

**220025 OPERATING AND MAINTENANCE MANUAL**

A. All operation and maintenance manuals **shall** be delivered by the Contractor to the Owner thru the Architect. The manual **shall** contain the following items as a minimum:

- 1. Index and page numbers.
- 2. Plumbing Contractor's signed one-year warranty.
- 3. Plumbing Contractor's contact information
- 4. List of subcontractors and suppliers with names, addresses, and phone numbers.
- 5. Third-party water quality test report.
- 6. Backflow preventer certificate of operation. This shall include all backflow preventers located within the building, including, but not limited to, double check backflow preventers at water heaters, backflow preventers at ice makers, and backflow preventers at HVAC make up water connections.
- 7. Submittal data, installation and operation manuals, and manufacturer's warranty info for the following (as applicable):
  - a. **EVERY** item listed in the "Plumbing Fixture Schedule" on the Contract Drawings
  - b. Gas regulators
  - c. Flow meters
  - d. Roof drains
  - e. Overflow roof drains
  - f. Downspout nozzles
  - g. Interceptors
  - h. Separators
  - i. Each piece of equipment specified under Division 22
- 8. All startup reports for equipment, as specified by Division 22. This shall include, but not be limited to, water heaters, pumps, air compressors, and vacuum pumps, as applicable.
- 9. Test reports for heat trace and heat maintenance cable systems, as applicable.

**220026 AS BUILT DRAWINGS**

- A. The General Contractor and Plumbing Contractor, shall maintain a set of drawings marked up to show the work as installed, including dimensions to and elevations of buried work. Both Contractors shall initial and date all changes to the contract drawings. The Architectural Observer may check this set of documents monthly for compliance. Upon completion of the work, return this set of drawings to the Architect.

**220027 FIXTURES**

- A. All exposed piping and metal parts shall be chrome plated. Slip joints will not be permitted except on fixture side of trap. Where rigid supplies are specified for fixtures and it is intended that they be installed true and plumb from fixture to wall rough in. Connections for water closets shall be made by use of flanges compatible to waste piping materials and verminproofed wax gaskets.

- B. **MANUFACTURER'S MODEL NUMBERS ARE PROVIDED FOR GENERAL INFORMATION ONLY.** Description of product shall take precedence over model numbers.
- C. All water closets shall flush properly when flushing with 25 PSIG at the flush valve.
- D. All urinals shall flush properly when flushing with 20 PSIG at the flush valve.
- E. All floors drains, floor sinks, and mop receptors shall have a deep seal P-trap installed below floor as a separate item. Joint connection shall be compatible to piping system.
- F. All floor-mounted water closets shall be set and grouted with white grout between floor and closet base.
- G. All wall-hung water closets and lavatories shall be sealed between wall and fixture with white or clear "G.E. Silicone Seal" caulking.
- H. All electric water coolers shall be sealed between wall and fixture with clear "G.E. Silicone Seal" caulking.
- I. All mop receptor basins shall be sealed between wall and fixture with clear "G.E. Silicone Seal" caulking.
- J. All counter mounted fixture rims shall be sealed with clear "G.E. Silicone Seal" caulking.
- WC-1 **WATER CLOSET:** (Adult ADA) 16-1/2"-17" high, floor mounted, vitreous china, elongated siphon jet water saver 1.28 GPF bowl with 1-1/2" top spud, china caps, and antimicrobial glaze, shall be Zurn Z5665-BWL1-AM, Sloan ST-2029-STG or approved equal by American Standard. Flush valve with 1" screwdriver angle check stop, vandal resistant stop cap, ADA flush handle, chloramine resistant dual filtered by-pass diaphragm, vacuum breaker, 1" chrome plated wall supply cover pipe, chrome plated cast brass escutcheon with set screw, 1-1/2" chrome plated flush pipe, Zurn Z6000AV-HET, Sloan No. 111-1.28 or approved equal by American Standard. White moltex open front seat with concealed stainless steel check hinge, less cover, American Standard 5901.100, Church No. 9500CT, Centoco 1500CCSS Bemis 1955SSCT, or Benekee 527. Contractor should note flush valve rough-in height as shown on the drawings. Flush valve handle shall be roughed in and mounted to the wide side of the toilet stall. Flush valve and water closet shall be by the same manufacturer.
- WC-2 **WATER CLOSET:** (Adult Standard) 15" high, floor mounted, vitreous china, elongated siphon jet water saver 1.28 GPF bowl with 1-1/2" top spud, china caps, and antimicrobial glaze, shall be Zurn Z5655-BWL1-AM, Sloan ST-2009-STG or approved equal by American Standard. Flush valve with 1" screwdriver angle check stop, vandal resistant stop cap, ADA flush handle, chloramine resistant dual filtered by-pass diaphragm, vacuum breaker, 1" chrome plated wall supply cover pipe, chrome plated cast brass escutcheon with set screw, 1-1/2" chrome plated flush pipe, Zurn Z6000AV-HET, Sloan No. 111-1.28 or approved equal by American Standard. White moltex open front seat with concealed stainless steel check hinge, less cover, American Standard 5901.100, Church No. 9500CT, Centoco 1500CCSS Bemis 1955SSCT, or Benekee 527. Contractor should note flush valve rough-in height as shown on the drawings. Flush valve handle shall be roughed in and mounted to the wide side of the toilet stall. Flush valve and water closet shall be by the same manufacturer.
- U-1 **URINAL:** (ADA) Wall hung, vitreous china, water saver, 0.125 GPF washout action with 2" wall outlet, 3/4" top spud and wall hanger, shall be Zurn Z5755-U, Sloan SU-1009 or approved equal by American Standard. Exposed manual 0.125 GPF diaphragm flush valve with 3/4" screwdriver angle stop valve, vandal resistant stop cap, ADA handle, vacuum breaker, 3/4" chrome plated flush pipe, chloramine resistant, clog resistant, and filtered by-pass diaphragm, shall be Zurn Z6003AV, Sloan 186-0.125, or approved equal by American Standard. Chair carrier with chrome plated cap nuts, Zurn Z-1222, or approved equal by J.R. Smith or Watts. Lip shall be mounted at height as shown on the drawings. Flush valve and urinal shall be by the same manufacturer.

- L-1 COUNTER LAVATORY: (Adult ADA) 21" by 16" vitreous china rectangular undermount bowl with front overflow, shall be Sloan SS-3021 or approved equal by Kohler or American Standard. Chrome plated lead free metering faucet to deliver 0.5 gpm per 10 second flow operation, with pressure compensating vandal resistant male laminar flow outlet, shall be Zurn Model Z86100-XL-22M or approved equal by Sloan or Chicago. Thermostatic lead free mixing valve with locking set point, 3/8" inlet check stops, 3/8" outlet, shall be installed under the lavatory to supply 110 F tempered water to the faucet. Mixing valve shall conform to ASSE 1070 or CSA B125.3 and shall be Watts Model LFUSG-B or approved equal by Combraco or Heatguard. Chrome plated lead free angle stops with loose key handle and 1/2" chrome plated nipple to wall and escutcheon with set screw shall be McGuire or approved equal by Zurn or Brasscraft. Stainless steel braided flexible supplies shall be as manufactured by McGuire or approved equal by Brass Craft, Watts. Chrome plated cast brass strainer with open grid, overflow openings, cast brass locknut and 1-1/4" 17 gauge tailpiece shall be McGuire, Zurn, or Engineered Brass Company. 1-1/4" by 1-1/2" chrome plated adjustable cast brass P-trap with 1-1/4" slip in inlet, cleanout, ground joint, 1-1/2" I.P.S. outlet, shall be McGuire, Zurn, or Engineered Brass Company. 1-1/2" chrome plated nipple to wall with escutcheon and setscrew shall be McGuire, Zurn, or Engineered Brass Company. Lavatory shall be mounted at height as shown on the drawings. Lavatory supplies and trap shall be protected by A.D.A. approved premolded insulation assembly as manufactured by Truebro, McGuire or Mainline.
- L-2 WALL HUNG LAVATORY: (Adult ADA) 20" by 18" vitreous china bowl with single center set punching, back ledge, self-draining deck, wall hanger, and front overflow shall be Zurn Z5361, Sloan SS-3103, or approved equal by American Standard. Chrome plated lead free metering faucet to deliver 0.5 gpm per 10 second flow operation, with pressure compensating vandal resistant male laminar flow outlet, shall be Zurn Model Z86100-XL-22M or approved equal by Sloan or Chicago. Thermostatic lead free mixing valve with locking set point, 3/8" inlet check stops, 3/8" outlet, shall be installed under the lavatory to supply 110 F tempered water to the faucet. Mixing valve shall conform to ASSE 1070 or CSA B125.3 and shall be Watts Model LFUSG-B or approved equal by Combraco or Heatguard. Chrome plated lead free angle stops with loose key handle and 1/2" chrome plated nipple to wall and escutcheon with set screw shall be McGuire or approved equal by Zurn or Brasscraft. Stainless steel braided flexible supplies shall be as manufactured by McGuire or approved equal by Brass Craft, Watts. Chrome plated cast brass strainer with open grid, overflow openings, cast brass locknut and 1-1/4" 17 gauge tailpiece shall be McGuire, Zurn, or Engineered Brass Company. 1-1/4" by 1-1/2" chrome plated adjustable cast brass P-trap with 1-1/4" slip in inlet, cleanout, ground joint, 1-1/2" I.P.S. outlet, shall be McGuire, Zurn, or Engineered Brass Company. 1-1/2" chrome plated nipple to wall with escutcheon and setscrew shall be McGuire, Zurn, or Engineered Brass Company. Chair carrier with floor anchor plate, upright supports, and bearing plate shall be Zurn Model Z-1224, J. R, Smith Model 0800 or approved equal by Watts. Lavatory shall be mounted at height as shown on the drawings. Lavatory supplies and trap shall be protected by A.D.A. approved premolded insulation assembly as manufactured by Truebro, McGuire or Mainline.
- SK-1 BREAKROOM SINK: (ADA) 22" x 17" x 7-5/8" deep bowl single compartment, self-rimming, 18-gauge, type 304 stainless steel sink with sound deadening applied to under side, customized with front overflow, shall be Just SL2217A-J, Elkay LR1722, or Acorn SD-1722-80. Stainless steel crumbcup strainer with 1-1/2" offset tailpiece shall be Elkay LKAD35, Just J-ADA-35 GR or approved equal by Acorn or McGuire. Hot and cold water supply faucet with replaceable ceramic disk cartridge, 5-1/4" restricted swing spout, 1.5 GPM vandal resistant laminar flow aerator, 4" vandal resistant wristblade handles, lead content equal to 0.25% by weighted average, Zurn Z812B4-XL-18F-140 or approved equal by Chicago or T & S Brass. Thermostatic lead free mixing valve with locking set point, 1/2" inlet check stops, 1/2" outlet, shall be installed under the sink to supply 120 F tempered water to the faucet. Mixing valve shall be ASSE 1070 approved and shall be

Watts Model LFMMV or approved equal by Combraco or Heatguard. 1/2" sweat x 1/2" compression sink supply stops shall be equipped with 5" extension, loose key ball valve angle stops shall be McGuire, Zurn, or Brasscraft. 1-1/2" x 1-1/2" chrome plated adjustable cast brass P-trap with 1-1/2" slip joint inlet, cleanout, and 1-1/2" 17-gauge tube outlet shall be McGuire, Zurn, or Brasscraft. Install cast brass escutcheons with setscrew on all piping entering base cabinet.

SK-2 COUNTER SINK: (ADA) 31" x 20" x 5-1/2" deep bowl single compartment, self-rimming, 18-gauge, type 304 stainless steel sink with sound deadening applied to under side, customized with front overflow, shall be Just CRAADA1931A55-J, Elkay DRKAD3119, or Acorn CADA-3120-55. Stainless steel drain fitting with stainless steel removable strainer shall be Elkay LK-99 or Just JB-99 GR or approved equal by Advance Tabco. Hot and cold water supply faucet with replaceable ceramic disk cartridge, 8" restricted swing spout, 1.5 GPM vandal resistant laminar flow aerator, 4" vandal resistant wristblade handles, lead content equal to 0.25% by weighted average, Zurn Z812C4-XL-18F-140 or approved equal by Chicago or T & S Brass. Thermostatic lead free mixing valve with locking set point, 1/2" inlet check stops, 1/2" outlet, shall be installed under the sink to supply 120 F tempered water to the faucet. Mixing valve shall be ASSE 1070 approved and shall be Watts Model LFMMV or approved equal by Combraco or Heatguard. 1/2" sweat x 1/2" compression sink supply stops shall be equipped with 5" extension, loose key ball valve angle stops shall be McGuire, Zurn, or Brasscraft. 1-1/2" x 1-1/2" chrome plated adjustable cast brass P-trap with 1-1/2" slip joint inlet, cleanout, and 1-1/2" 17-gauge tube outlet shall be McGuire, Zurn, or Brasscraft. Install Streim sidekick under-sink solids interceptor between strainer and p-trap. Install cast brass escutcheons with setscrew on all piping entering base cabinet.

SK-3 NURSING SINK: (Adult ADA) 20" by 18" vitreous china bowl with single center set punching, back ledge, self-draining deck, wall hanger, and front overflow shall be Zurn Z5361, Sloan SS-3103, or approved equal by American Standard. Chrome plated, lead-free, cast brass manual faucet, with replaceable quarter turn ceramic disc cartridges, color coded vandal proof 4" wristblade handles, 1.5 gpm aerator, with 5-3/8" restricted swing spout Zurn Z812B4-XL-140-17F or approved equal by Sloan or Chicago. Thermostatic lead free mixing valve with locking set point, 3/8" inlet check stops, 3/8" outlet, shall be installed under the lavatory to supply 110 F tempered water to the faucet. Mixing valve shall conform to ASSE 1070 or CSA B125.3 and shall be Watts Model LFUSG-B or approved equal by Combraco or Heatguard. Chrome plated lead free angle stops with loose key handle and 1/2" chrome plated nipple to wall and escutcheon with set screw shall be McGuire or approved equal by Zurn or Brasscraft. Stainless steel braided flexible supplies shall be as manufactured by McGuire or approved equal by Brass Craft, Watts. Chrome plated cast brass strainer with open grid, overflow openings, cast brass locknut and 1-1/4" 17 gauge tailpiece shall be McGuire, Zurn, or Engineered Brass Company. 1-1/4" by 1-1/2" chrome plated adjustable cast brass P-trap with 1-1/4" slip in inlet, cleanout, ground joint, 1-1/2" I.P.S. outlet, shall be McGuire, Zurn, or Engineered Brass Company. 1-1/2" chrome plated nipple to wall with escutcheon and setscrew shall be McGuire, Zurn, or Engineered Brass Company. Chair carrier with floor anchor plate, upright supports, and bearing plate shall be Zurn Model Z-1224, J. R, Smith Model 0800 or approved equal by Watts. Lavatory shall be mounted at height as shown on the drawings. Lavatory supplies and trap shall be protected by A.D.A. approved premolded insulation assembly as manufactured by Truebro, McGuire or Mainline.

SK-4 EXTERIOR SINK (Adult ADA): Wall mounted, single compartment, 14 gauge 304 series stainless steel sink with 45" by 16.5" by 6.5" deep compartment, 4.5" high backsplash, center drain outlet, (2) sets of 8" O.C. faucet holes, Just JHADA4820-2S1H-J-4. Polished chrome-plated cast brass sink faucets with, 5-3/8" gooseneck spout, vandal-resistant 4" wrist blade handles, 1.5 gpm aerator, back mounted, Zurn Z841B4-XL-17F or approved equal by Chicago Faucets or T and S Brass. Thermostatic lead free mixing valve with locking set point, 3/4" inlet check stops, 3/4" outlet, shall be installed on incoming supply to sink so as to deliver 120 F tempered water to the faucets. Mixing

valve shall be ASSE 1070 approved and shall be Watts Model LFMMV or approved equal by Conbraco or Heatguard. Install Streim sidekick under-sink solids interceptor in drain pipe.

- EWC-1 ELECTRIC WATER COOLER: (Dual Height) Wall mounted, dual height, vandal resistant, air cooled type water cooler with matching drinking fountain with stainless steel anti-splash receptor, stainless steel cabinet, in line 'Y' strainer, anti-squirt dual stream bubbler, automatic stream regulator, front and side push buttons, hands free bottle filler, visual filter monitor, wall hangers, sealed hermetic compressor with capacity of 8-GPH of 50 °F drinking water at 90°F. room temperature and 80°F. inlet water temperature, Elkay LZSTL8WSSK, or approved equal by Murdock, or OASIS factory wired for 115 volt, single phase electrical service. Chair carrier with steel upright support legs, backing plates shall be Zurn Z-1225-BL, or approved equal by J.R. Smith or Watts. The Plumbing Contractor shall furnish the electrical receptacle rough-in dimensions to the Electrical Contractor to provide for a concealed electrical service to the unit. Plumbing Contractor shall provide PVC P-trap the same size as the electric water cooler drain. Wheel handle lead free stop valve shall be McGuire LF175 or approved equal by Zurn or Watts. Plumbing Contractor should note that spout shall be set at height as shown on the drawings.
- MR-1 MOP RECEPTOR: 24" x 24" x 10" deep molded stone receptor with 3" inside caulked drain, stainless steel strainer, Fiat Model MSB-2424, Williams Model MTB 2424 or Mustee Model 63. Wall mounted, polished chrome plated supply faucets with top brace, vacuum breaker, integral screwdriver shank check stops, 3/4" hose end, T&S B-0665-BSTP, Chicago 540-LD897SWXFXKCAB or approved equal by Zurn. Heavy duty, cloth reinforced rubber hose and hose hook, Fiat Model 832-AA, Williams Model T-35, or Mustee Model 65.700. Wall mounted, 24" long, 3 mop spring clip hanger, Fiat Model 889-CC, Williams Model T-40, or Mustee Model 65.600. Stainless steel wall guards with corner bracket shall be Fiat Model MSG 2424 or approved equal Williams, or Mustee 67.2424. Supply faucet outlet shall be mounted 24" above receptor floor. Contractor should note that joint between receptor, wall and floor should be sealed with clear silicone sealant.
- HB-1 HOSE BIBB: (In-Box) Commercial seamless 18 gage, type 304 stainless steel recessed hose box with wall flange for single temperature, cylinder key lock with stainless steel door and concealed hinges, lead free stainless steel valve body and stop, removeable wheel handle for loose key operation, provide manufacturers optional loose key, 3/4" vacuum breaker outlet, 3/4" inlet, serviceable from front of the valve, compatible with installation in typical 3-5/8" stud wall, shall be Prier P-623-CL or approved equal by Acorn or Murdock.
- HB-2 HOSE BIBB: Wall mounted, polished chrome plated brass with 3/4" vacuum breaker hose end, metal wheel handle, 1/2" inlet wall flange, Woodford Model 26P-1/2, Mifab MHY-9230, or Preir C-155-CP.50.
- HB-3 WALL HYDRANT: Non-freeze type with 3/4" copper inlet, 3/4" vacuum breaker hose end, removable key handle, self draining, for wall thickness as required, Woodford Model 65, Zurn Model Z-1321, Prier C-634 or Josam Model 71050-12.
- HB-4 WALL HYDRANT: Mild climate commercial wall hydrant with 3/4" straight pattern inlet, 3/4" vacuum breaker hose end, backflow check valve, lose key handle, self-draining, Prier C-633NCC, Zurn Z1334-C, or approved equal. Water supply piping shall be installed within the building's thermal envelope to prevent freezing and shall be installed in such manner to allow for winterization. Winterization shall be provided via shut off valve inside the building with supply piping from valve to fixture sloped to drain to the exterior through hydrant.
- FD-1 FLOOR DRAIN: (Square – Post pour adjustment) Cast iron body drain with 2" outlet to match piping system, 6" square nickel bronze heelproof top, vandal resistant securing

screws with flashing device, concrete shield, post pour vertical and tilt adjustment, Zurn ZN415-SZ1-VP, or approved equal by Watts or Sioux Chief.

- FD-2 FLOOR DRAIN: (Round – Post pour adjustment) Cast iron body drain with 4" outlet to match piping system, 6" round nickel bronze heelproof top, concrete shield, post pour vertical and tilt adjustment, Zurn ZN415-BZ1, or approved equal by Watts or Sioux Chief.
- FS-1 FLOOR SINK: 12" x 12" x 6-3/8" deep sump polymer PVC floor sink with 3" outlet to match piping system, smooth internal surface, secured dome strainer with lock-in sediment bucket, 1" lip above finished floor, half stainless steel grate, Zurn FS12-6-PV3-Y-SH, or approved equal by Josam or J. R. Smith.
- CB-1 ICE MAKER CONNECTION BOX: Fully recessed unit with lead free cold water shut-off valve, compression nut and ferrule as shall be LSP Products Group model OB-801-LL, IPS Corporation model AB9700 or approved equal Oatey Company.
- CB-2 WASHER CONNECTION BOX: Fully recessed 18 gage type 304 stainless steel washing machine outlet box with hot and cold water hose connections, screw driver stops, vacuum breakers, and 2" drain outlet. Unit shall be Acorn 8186-sslf, Willoughby HB-8181, or approved equal by Guy Gray.
- DW-1 DISHWASHER: Unit provided by others. Plumbing Contractor shall provide dishwasher sink drain tailpiece (to match drainage system) and connect 3/4" drain to adjacent sink tailpiece using 3/4" fiber reinforced hose and hose clamps. Hot water supply shall be installed using 1/2" type 'L' soft copper equipped with lead free ball valve stop. Provide sufficient coil of piping to facilitate removal of unit for servicing
- WH-1 WATER HEATER: Factory assembled electric 65-gallon storage type heaters shall be equipped with glass lined steel tanks, ASME pressure temperature relief valve, magnesium anode rod, powered anode, element sensing, tank drain with hose connection, ASHRAE/IESNA 90.1 insulated factory applied baked enamel finish jacket, two-18kW incoloy immersion elements, and advanced electronic control box. Heater shall be controlled by immersed bulb thermostat and be equipped with high limit temperature control, control box, transformer, contactors and junction box. Control circuits shall be a maximum of 120-volts. Heaters shall be ASME constructed and labeled. Heaters shall be U.L. listed and shall carry 3-year factory warranty. Heater shall be factory wired for 208-volt, three-phase electrical service as shown on the plans and shall be A.O. Smith Custon Xi DSE-65A, or approved equal by State, Mor-Floor or Rheem. Water heater shall be started by the manufacturer's factory representative.

## **220028 GUARANTEE**

- A. Guarantee: The Contractor shall guarantee the entire plumbing system subject to the General Conditions of these specifications.

### **END OF SECTION**

**SECTION 23 0500**  
**HEATING AND AIR CONDITIONING**

**230501 GENERAL**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. The Heating and Air Conditioning Contractor shall cooperate with the contractors of other trades and shall install his work as fast as the progress of the balance of the work will permit.
- C. The Heating and Air Conditioning Contractor shall install all work in accordance with the requirements of the latest edition of the North Carolina State Building Code. Codes to be a part of these specifications: North Carolina State Building Code, National Fire Protection Association Codes Section 70, 90A, 91 and other applicable sections.
- D. Inspection by local authorities will be required.
- E. The drawings accompanying these specifications indicate diagrammatically the general location of the ducts, piping, and equipment and do not show all offsets, supports, fittings, bolts, connections, etc., required for a complete system. While the drawings are to be followed as closely as possible, if it is found necessary to change the location of same to accommodate the conditions at the building, such changes shall be made without additional cost to the Owner, and as directed by the Engineer. Any detail which is omitted, and which is necessary for the proper operation of any system included under the contract, shall be supplied and installed by the Heating and Air Conditioning Contractor without extra cost to the Owner. All pipes and ducts shall be run as high as possible to maintain ceiling and head clearance. All equipment shall be installed in such a manner as to allow proper maintenance access.
- F. Equipment and Materials shall be delivered to the site and stored in original containers, suitably sheltered from the elements, but readily accessible for inspection by the Engineer until installed. All items subject to moisture damage shall be stored in dry spaces.
- G. Conditions shall be checked at the building before placing orders for apparatus and such apparatus shall be of such dimensions as to fit the spaces allotted. The Heating and Air Conditioning Contractor shall not scale mechanical plans, but rather refer to architectural plans for dimensions.
- H. By signing the Contractor's Proposal, it is understood and agreed that the Heating and Air Conditioning Contractor has, by careful examination, satisfied himself with the quantity, quality, and location of all excavation materials to be encountered in his contract.
- I. All debris resulting from heating and air conditioning work shall be removed from the premises daily or as directed by the Engineer. Trash and rubbish shall not be allowed to accumulate either within or outside the building. Materials and debris, which in the opinion of the Engineer cannot practicably be removed from the site the same day, may be temporarily stacked or stored in a designated location on the site as directed by the Engineer.
- J. Guards shall be provided for all moving equipment, motor couplings, pump shafts, belt drives and similar exposed reciprocating or rotating components.
- K. All HVAC and refrigeration equipment shall be labeled in accordance with Section 301 of the North Carolina Mechanical Code and as required by the Authority having jurisdiction. Labeling shall be a permanent factory-applied nameplate affixed to the equipment on which shall appear in legible lettering, the manufacturer's name or trademark, the model, serial number, and the seal or mark of the testing agency.

**230502 SCOPE**

- A. The Heating and Air Conditioning Contractor shall provide labor and materials required for a complete system ready for operation as shown on the drawings and hereinafter specified. This includes all equipment, ductwork, necessary plumbing, and all other services necessary whether they are specifically mentioned herein or not. The entire installation shall be installed in a first-

class, neat, professional manner to the satisfaction of the Engineer and shall conform to all applicable codes and laws.

**230503 SHOP DRAWINGS AND SUBMITTAL DATA**

- A. The Heating and Air Conditioning Contractor shall submit within 10 days after award of the contract a list of materials and the manufacturer to be used on this project. He shall submit within thirty days after award of the contract at least five copies of submittal data in written form for the Engineer's use in approving materials and equipment. One copy will be returned. If the Heating and Air Conditioning Contractor desires the return of more than one copy, additional copies shall be provided to the Engineer at the time of the original submission. It is requested that all submittal data be sent to the Architect at one time. Unless special consideration is given, none of the submittal data will be checked until it has all been received by the Architect. Where called for, the Heating and Air Conditioning Contractor shall submit five sets of shop drawings showing the detailed arrangement or connections that are shown schematically on the drawings. Data certified for the specified project and indicated manufacturer, type, or size, capacity, etc., shall be submitted for the following equipment items:
1. Packaged Heat Pumps
  2. Power Ventilators and Gravity Ventilators
  3. Diffusers, Grilles, and Registers
  4. Heaters
  5. Controls with Complete Diagram
  6. Fire, Manual, and Motorized Dampers
  7. Access Doors
  8. Spiral Ductwork
  9. Insulation
  10. Testing and Balancing

**230504 APPROVED EQUAL EQUIPMENT, ETC.**

- A. Manufacturers listed are to establish a standard of quality and not intended to limit the selection to these manufacturers. All materials and equipment which are essential and have not been specified or shown shall be new and of the highest grade and quality, free from defect or other imperfections. It should be understood that where the word "provide" is used, it is intended that the Heating and Air Conditioning Contractor shall purchase and install all materials required. Approval of equipment will not relieve the Contractor of compliance with the specifications even if such approval is made in writing, unless the attention of the Engineer is called to the non-complying features by letter accompanying the submittal data. Approval of submittal data by the Engineer shall not be construed as a complete check of approval of detailed dimensions, weights, gauges, and similar details with the proposed articles. The conformance with the necessary coordination between the various other contractors and suppliers shall be solely the responsibility of the Heating and Air Conditioning Contractor.

**230505 PACKAGED HEAT PUMPS**

- A. Units shall be downflow with cooling performance rated in accordance with AHRI standards. Unit shall be factory assembled, piped, internally wired, fully charged with refrigerant and 100% run tested to check full operation, fan and blower rotation and control sequence before leaving the factory. Wiring internal to the unit shall be numbered for simplified identification. Unit shall be UL listed and labeled, classified in accordance to UL 1995/CAN/CSA No. 236-M90 for Central Cooling Air Conditioners.
- B. Units shall have the following characteristics:
1. High efficiency DX cooling and heating.
  2. Factory installed modulating hot gas reheat - dehumidification control. Minimum 6" space between evaporator coil and reheat coil.
  3. Auxiliary electric heating coil.
  4. Downflow airflow.

5. Constant Volume or Single Zone Variable Air Volume supply airflow as indicated on the drawings.
  6. Multiple or staged compressors where indicated on the drawings.
  7. High pressure control.
  8. Factory installed refrigerant leak detection system and safety sequence of operation.
  9. Factory installed 0-100% outside air dry bulb economizer with gravity damper for relief where indicated on the drawings.
  10. Factory mounted controllers on the packaged heat pump with programable space sensors for temperature and relative humidity control in the space. Sensors to have connection to building's Wi-Fi.
  11. Phase monitor.
  12. Roof curb, vibration isolation type roof curb where indicated on the drawings.
- C. Unit casing shall be such that all components are mounted in a weather resistant steel cabinet with a painted enamel finished exterior. Service panels as hinged doors with water and air tight seals shall be provided for unit controls, indoor coils and fans with a water and air tight seal. Indoor air section shall be completely insulated with fire resistant, permanent, odorless, foil faced glass fiber material.
- D. Compressors shall be hermetically sealed, direct drive, scroll type with internal over current and over temperature protection, crankcase heaters, and high pressure control. Provide be multi-stage where indicated on the drawings.
1. Systems using A2L refrigerant shall be listed to UL Standard 60335-2-40, current edition.
  2. Per EPA SNAP 23, systems using A2L refrigerant shall have permanently affixed markings and labeling to indicate refrigerant installed in the system and Notice of leak detection system installed, and shall have service ports, pipes, hoses and other devices through which refrigerant flows to be marked in red.
  3. Systems using A2L with refrigerant charge > 4.0 lbs in largest independent circuit shall have integral factory installed refrigerant leak detection system mounted in the air handling unit section downstream of the evaporator coil with internal controls to automatically upon refrigerant detected, unit commands compressors and electric heat (if present) off, and commands air handling unit's fan to maximum airflow for air circulation. Once refrigerant has not been detected for a minimum of 5 minutes, unit shall return to normal operation.
  4. For systems using A2L refrigerant, if releasable refrigerant charge in the system exceeds the levels allowed in ANSI/ASHRAE Standard 15 – 2022 or newer for the effective dispersal volume, provide safety isolation valves in both refrigerant lines as release mitigation controls. Valves shall automatically close upon signal from the unit integral refrigerant leak detector. Valve locations shall be as such for releasable refrigerant charge to be less than the levels allowed in ANSI/ASHRAE Standard 15 – 2022 or newer for the effective dispersal volume.
  5. As part of submittals, provide calculated releasable refrigerant charge in largest independent circuit for each system, including connecting piping.
- E. Condenser coils shall have tubes mechanically bonded to spine aluminum fins. Evaporator coils and hot gas reheat coils shall be copper tubes mechanically bonded to high performance aluminum plate fins. All coils shall be leak tested to 200 psig and pressure tested to 450 psig. Provide guards on units to fully protect condenser coils from hail and vandalism.
- F. Units shall have forward curve, direct or belt driven centrifugal indoor fans with permanently lubricated motor bearings. Motors shall be EISA 2007 NEMA premium efficiency with 1.15 service factor and shall be Model J ball bearing with minimum NEMA design "B" for 40°C ambient. Efficiency rating shall be stamped on motor nameplate. Motors shall have thermal overload protection. Motor/blower assemblies shall be isolated from the unit via rubber mounts. Fans shall have factory VFD where being provided for Single Zone Variable Air Volume supply airflow. Belt drive fans shall have adjustable variable pitch selected at a minimum service factor of 1.2. Heating and Air Conditioning Contractor shall provide one new set of drive belts installed in units

at final inspection and provide a spare drive belt set for each unit. Belt set shall be secured inside each unit. After final assembly, the entire unit shall be given final vibration test.

- G. The outdoor fan shall be direct-drive statically and dynamically balanced, draw through in the vertical discharge position. The fan motors shall be permanently lubricated and have built-in thermal overload protection.
- H. Units shall be completely factory wired with necessary controls and terminal block for power wiring. Units shall have a single point power entry with HACR circuit breaker. Unit protection shall include phase monitoring. Coordinate power connection routing and location with the Electrical Contractor.
- I. Auxiliary heating section shall be an open-wire resistance heater factory installed. Heater shall have automatic resetting limit switches and heater limits for thermal protection. Heater shall be UL listed. Electric heaters shall be equipped with adjustable outdoor thermostats for each stage of heat. Auxiliary heaters shall have quantity of stages as indicated on the drawings as a minimum.
- J. Filters shall be 2" thick UL Class 1 pleated panels with Minimum Efficiency Reporting Value of MERV 8 per ASHRAE Standard 52.2-1999. Contractor shall supply complete sets of filters to protect his equipment during construction, another change of filters at completion, and leave one additional complete set of filters at the building for the next change. Provide factory supplied fixed filter blockoffs to prevent air bypass around filters.
- K. Unit's dampers shall have metal compressible jamb seals and extruded vinyl blade edge seals. Units shall have motorized outside air intake and return air dampers to modulate open and provide the specified outside air. Where indicated on the drawings, units shall have outside air economizers capable of providing 100% outside air even if additional mechanical cooling is required to meet the cooling load of the building. Relief gravity dampers shall provide means to relieve excessive outdoor air during economizer operation to prevent over pressurizing the building. Outside air intake and relief air openings shall have rain hood with moisture eliminator and bird screen.
- L. Condensate drain pan shall be insulated positively sloped of durable, long-lasting and corrosion resistant construction.
- M. Curbs shall be custom made from 12 gauge or heavier as required galvanized steel with welded construction, vibration isolation type where indicated, and 1-1/2" thick rigid insulation. Curb height shall be a minimum of 16" high above finished roof height. Secure curb to roof structure and unit to curb per manufacturer's recommendations for site's wind zone loading.
- N. Startup and testing shall be by factory authorized service representative.
- O. Units shall have factory controller. Each unit shall include a cable connected touch-sensitive color display for unit controller interface. Coordinate hardwired space controls, including sensors, etc. to be provided in the unit by the unit manufacturer. Include hardware and software for wi-fi connection to each unit. Systems using A2L refrigerant shall be listed to UL Standard 60335-2-40, current edition.
- P. Units shall have a one-year warranty on entire unit and four-year extended warranty for the compressors only. Labor, freight, refrigerant, and other required parts shall be provided or paid for by the Owner.
- Q. Units shall be Trane, Carrier, York or approved equal.

#### **230507 POWER VENTILATORS AND GRAVITY VENTILATORS**

- A. Power ventilators shall be tested and rated in accordance with the standards of AMCA 210 and shall carry the AMCA seal. All fans shall be UL labeled. Fans shall be Cook, Greenheck, Carnes, PennBarry, or approved equal.
- B. Power roof ventilators shall be centrifugal, direct or belt driven and upblast or downblast as indicated on the drawings with factory applied finish of color selected by the Architect. All units shall be provided with bird screen, and back draft dampers. Disconnect switches shall be by the

Heating and Air Conditioning Contractor. Power roof ventilators shall have spun aluminum hood. Motors shall be EISA 2007 NEMA premium efficiency with efficiency rating stamped on motor nameplate. Belt drive units shall have adjustable V-drive. Provide spare belts for belt drive units. Direct drive units shall have solid state motor speed controllers with an "OFF" position.

- C. Ceiling exhaust fans shall have plug disconnect switch, interior fiberglass insulation, forward curved centrifugal blower wheel, back draft dampers, permanently lubricated motor, and white steel grille. Fan grille shall have factory mounted and wired adjustable occupancy sensor where indicated on the drawings. Units shall have solid-state motor speed controller with an "OFF" position. Furnish wall cap with birdscreen where shown on drawings. Caps shall have baked enamel finish of color selected by the Architect.
- D. Gravity ventilators shall be heavy gauge aluminum with factory applied finish of color selected by the Architect. Mounting base shall be prepunched and include an integral spun venturi. The internal structure shall be constructed of galvanized steel for rigid support and includes a windband and birdscreen. Bird screen shall be 1/2" x 1/2" PVC coated wire.
- E. Roof curbs for roof-mounted equipment shall be provided by the Heating and Air Conditioning Contractor. It shall be the responsibility of the Heating and Air Conditioning Contractor to give the General Contractor the proper locations and sizes required for all roof openings. Opening will be framed and cut by the General Contractor. Roof curbs shall be insulated and finished with factory applied finish of color selected by the Architect. Equipment shall be attached to roof curbs with a minimum of two stainless steel fasteners and EPDM washers on each side of roof curb.

#### **230506 DIFFUSERS, GRILLES, AND REGISTERS**

- A. Diffusers, Grilles, and Registers shall be as manufactured by Carnes, Metal Aire, Titus, Krueger, Price, or approved equal unless otherwise noted.
- B. All diffusers, grilles, and registers shall have a maximum NC level of 25 in the space for the specified airflow and shall have factory applied white baked enamel finish. Where indicated on drawings to be field painted, white factory finish shall be as necessary to receive field finish painting.
- C. Lay-In Ceiling Supply Air Diffusers: Shall be aluminum construction, fixed square louvered face, 4-way blow, panel border to drop in 24" x 24" "T" bar ceiling grid, with adjustable vertical pattern. Vertical air adjustment shall be made by adjusting four perimeter blades to force air down in a vertical position.
- D. Regular Ceiling Supply Air Diffusers: Shall be aluminum construction square louvered face design, 4-way blow, with adjustable vertical pattern and opposed blade dampers. Pattern adjustment shall be the same as for lay-in supply air diffusers.
- E. Sidewall Linear Bar Grilles: Shall be extruded heavy duty aluminum bar blades locked into extruded aluminum border. Blades shall be fixed 45° deflection on 1/2" centers running parallel to the long dimension of the grille with reinforcing support bars. Border shall be 1" width suitable for sidewall mounting complete with precise factory mitered corners and concealed mounting. Border and blade factory finish shall be powder coat of color selected by Architect. Provide factory-insulated plenum box.
- F. Spiral Duct Supply Air Grille: Shall be aluminum with double deflection individually adjustable blades, front blades parallel to short dimension on 3/4" blade spacing. Border frame shall be welded aluminum 1-1/4" flat standard with countersunk screw holes for mounting in spiral ductwork. Provide an air scoop for balancing. Grille shall be white factory finish as necessary to receive field finish painting. Final color to be selected by the architect.
- G. Sidewall Supply Air Registers: Shall be aluminum with adjustable front vertical and back horizontal airfoil vanes on 2/3" centers and opposed blade dampers.
- H. Lay-in Ceiling Return Air Registers: Shall be aluminum 1/2" x 1/2" egg crate with aluminum frame and designed to lay in an inverted "T" bar ceiling grid. Grilles shall be full flow across the entire face of grille and tapered up to neck size. Registers shall have opposed blade dampers.

- I. Ceiling Return Air Registers: Shall be aluminum 1/2" x 1/2" egg crate with aluminum frame and opposed blade dampers. Registers shall be full flow across the entire face of register and tapered up to neck size.
- J. Side Wall Return Air Grilles and Registers: Shall be aluminum with fixed 40° horizontal face bars. Face bars shall be 1/8" thick with rounded edges. Registers shall have opposed blade dampers.
- K. Exhaust Registers: Shall be aluminum construction with fixed blades on 1/2" centers set at 35° angles and opposed blade dampers.

#### **230507 HEATERS**

- A. Electric baseboard heaters shall be commercial grade furnished and installed complete with all necessary heating elements, brackets, and closures, splice plates, interior and exterior corners, and accessible wiring compartment. Maximum leaving air temperature at the outlet and enclosure surface temperature, under continuous operation, shall not exceed 200°F. Heaters shall be Markel Series 2900C, Q Mark, Raywall or approved equal complete with UL label.

Heating elements shall consist of stainless steel element rod with aluminum fins. Maximum watt density per linear foot of element shall not exceed 250 watts. Enclosures shall be steel with thicknesses not less than 18 gauge front and 22 gauge back and shall be rigidly reinforced. Enclosures shall be wall hung with bottom at elevation above the finished floor as shown on the drawings, and shall be suitable for the space available. End plates and corner pieces shall be die formed with round edges, fit flush with enclosure surface, and be neat in appearance. No direct contact between enclosure and heating element will be permitted. Enclosure shall be painted with rust inhibiting paint at the factory and shall have baked enamel finish of color selected by Architect. Connection box shall be designed to permit power supply and control wiring from bottom, rear, right or left side as required. Thermostat shall be built in double pole double throw adjustable with extra sensitive bulb and capillary. Thermostat shall have positive off position and be within unit enclosure or junction box. Limit controls shall be continuous end to end automatic reset thermal overload; line voltage protection shall be provided with each individual baseboard heater to protect from overheating due to any cause. Baseboard unit shall be furnished complete, factory prewired and ready to receive branch circuit and connections. Each heater shall be provided with a factory installed safety disconnect switch or circuit breaker installed in the housing or in an auxiliary matching control section or have thermostat with positive off position.

#### **230508 CONTROLS**

- A. See Section 230900.

#### **230509 FIRE, MANUAL, AND MOTORIZED DAMPERS**

- A. Fire dampers shall be provided in the duct systems in accordance with NFPA Standard No. 90A and shall conform to NFPA Standard No. 90A for materials and workmanship. The dampers shall be spring loaded dynamic rated multi-leaf type UL approved and labeled for installation into the rated assembly (a 1-1/2 hour damper for a 2 hour rated assembly and two 3 hour dampers for a 4 hour rated assembly) and shall be installed according to the manufacturer's recommendations. Dampers shall be Ruskin, Pottorff, Prefco, United Enertech, Greenheck, Nailor or approved equal.
- B. Manual and Motorized dampers shall be low leakage type provided in the duct systems as indicated on the drawings in accordance with NFPA Standard No. 90A and shall conform to NFPA Standard No. 90A for materials and workmanship. Blades shall have extruded vinyl double edge seals. Jams shall have flexible metal compression type seals. Maximum damper leakage at 1.0 in w.g. shall be 10 cfm/sf of damper area for motorized dampers. For manual dampers, maximum damper leakage at 1.0 in w.g. shall be 40 cfm/sf of damper area for dampers smaller than 24 inches in either dimension, and shall be 20 cfm/sf for larger manual dampers. Leakage ratings shall be when tested in accordance with AMCA Standard 500. The dampers shall have electric operators and shall be normally closed. Wiring to operators shall be by the Heating and Air Conditioning Contractor. To facilitate service access and insulation installation, manual

damper handles shall be on 2" stand-off brackets. Handles shall be spray painted red. Dampers shall be installed according to the manufacturer's recommendations. Dampers shall be Ruskin, Pottorff, Prefco, Air Balance, United Enertech, or approved equal.

**230510 ACCESS DOORS**

- A. Access doors shall be provided for access to all fire and motorized dampers, duct mounted smoke detectors, and duct systems as necessary.
- B. Duct mounted access doors shall be constructed of No. 22 US gauge zinc-coated sheet steel and shall be gasketed, air tight and provided with not less than two (2) cam-type latches. Doors shall be square and shall be 12" x 12" or two inches less than the height of the duct. Doors shall be two-piece with 1" rigid insulation between the metal sides. Doors shall have engraved plastic laminated labels with 1/2" tall letters indicating item accessed through door.
- C. Wall and ceiling access doors shall be provided as specified in Section 083113.
- D. Provide 3/4" diameter red dot on ceiling grid below all duct access doors.

**230511 ELECTRICAL**

- A. Electrical circuit sizes are based on capacities of the drawings and it shall be the responsibility of Heating and Air Conditioning Contractor to change any and all electrical work in order to fit mechanical equipment. Heating and Air Conditioning Contractor shall coordinate with Electrical Contractor to assure that all units are properly connected and shall check wiring prior to starting units. Any damage to units resulting from improper wiring or connections shall be the responsibility of Heating and Air Conditioning Contractor. Flexible electrical conduits shall be 18 inches in length maximum. All electrical work shall be installed in accordance with codes having jurisdiction and the Electrical Division, Division 26, of these specifications.
  - 1. Heating and Air Conditioning Contractor shall provide means at each unit for fire alarm shutdown of equipment whether or not equipment is in auto or manual mode of operation. Wiring from fire alarm system will be by the Electrical Contractor. Power wiring to equipment shall be through the starter.

**230512 DUCTWORK**

- A. Mechanical drawings are schematic only and do not show all offsets etc. required. Heating and Air Conditioning Contractor shall familiarize himself with the complete contract documents and site conditions before fabricating ductwork. Any changes to ductwork found necessary to accommodate the conditions at the building shall be made without additional cost to the Owner, and as directed by the Engineer.
- B. During construction, interior of ductwork shall be protected. All open ends of ductwork shall be covered with self-adhesive 3 mil polyethylene film.
- C. All dimensions on the drawings are free inside dimensions.
- D. Ductwork shall be of galvanized steel with standard gauges and construction in accordance with the recommendations of SMACNA HVAC Duct Construction Standards, Metal and Flexible, Third Addition, 2005 for appropriate pressure class. Elbows shall be long radius type or have airfoil turning vanes with 1-1/8" spacing and rail support system in all 90° square throat elbows. Ductwork shall be cross broken on all sides and shall be supported at both ends of each joint and at 10'-0" intervals maximum with galvanized angles supported by galvanized threaded rods of sizes and spacing in accordance with SMACNA. Ductwork to be exposed shall be constructed in a first class, neat, professional manner and exposed ductwork with excessive hammer marks shall be replaced. Round supply takeoffs from trunk ducts shall be made with factory 45° entry branch rectangular to round type fittings. Provide dampers in takeoff fittings where indicated on drawings. Damper handles shall be on 2" stand-off brackets. Handles shall be spray painted red. Splitter dampers shall be provided where indicated with adjustment quadrant locking device and shall be constructed of two thicknesses of 24-gauge-galvanized steel. All components of the air distribution system shall be mechanically fastened with at least three equally spaced sheet metal screws with screws not more than on 12" centers. All duct joints shall be sealed in

accordance with SMACNA Seal Class A before insulation is applied. All sealants shall meet the provisions of UL181. Sealant shall be Sonolastic NP1.

- E. Final 8'-0" of the runout to the air outlet may be factory fabricated flexible ducts complying with NFPA Standard No. 90A, UL 181, and shall be UL Class 1 R-6 insulated type with foil vapor barrier. The flexible duct shall be air tight for factory test when bent to full recommended radius and under not less than 10" water gauge internal pressure and shall be limited to 8'-0" maximum length. Flexible ducts shall be supported by galvanized steel straps in accordance with SMACNA at intervals not exceeding 4'-0" and at each change of direction. Flexible ducts shall have a minimum of one support.
- F. Spiral ductwork shall be round or flat oval spiral lockseam as indicated on the drawings with gauges per SMACNA, flanged joints, paint-grip finish to receive painting by the General Contractor, double wall, and internally insulated at the factory. Inner wall shall be perforated. Provide factory angle trim ring at wall penetrations. Duct shall be fastened using sheetmetal screws only and no duct tape. Dents in ductwork will not be acceptable and ductwork shall be replaced by the Heating and Air Conditioning Contractor. Diffuser, register, and grille openings shall be double wall internally insulated and made at the factory ready for the air distribution device.

### **230513 PIPING**

- A. The Heating and Air Conditioning Contractor shall furnish all piping and supports necessary to provide a complete system as shown or intended by the plans and specifications. All piping shall be inspected, tested, and approved before being insulated or concealed. Piping 2" and smaller shall be welded or have screwed fittings with extra heavy nipples, unless otherwise noted. Piping 2-1/2" and larger shall have welded fittings of the same material and weight as the piping in which they are installed. Pipe shall be clean, run generally parallel to the building and have all open ends closed with iron caps at all times. Eccentric reducers shall be used in horizontal runs and concentric reducers in vertical runs. All piping and fittings shall have manufacturer's identification and ASTM designation incorporated thereon.
- B. Drain pan condensate and pumped condensate piping above slab shall be Type M copper with all joints soldered with 95-5 solder where interior. Piping shall have dielectric union at connection to ferrous pipe.
- C. On building's exterior, condensate piping shall be Schedule 40 PVC with solvent cemented joints. Drain pan condensate piping shall have a minimum slope of 1/4" per linear foot, and shall be at least as large as unit condensate connection.
- D. Welding material and labor shall be in accordance with welding procedures of the American Standards Code for Pressure Piping ASA B31.9. Welders shall be fully qualified in above specified procedure, tested, and so certified by an approved Welding Bureau of Locally Recognized Testing Authority. Welding shall be electric arc or oxyacetylene welding method as approved using electrodes and rods that comply with ASTM specifications.
- E. Swing joints or loops shall be provided wherever necessary to allow for expansion of piping. Broken piping or fittings shall be removed and replaced at the Heating and Air Conditioning Contractor's expense.

### **230514 PIPE HANGERS**

- A. All piping shall be neatly and securely supported by hangers from fire resistance rated structural elements of the building spaced in the following manner:
  - 1. Copper Piping 1-1/4" and smaller - 6'-0" O.C.
  - 2. Copper Piping 1-1/2" and larger - 10'-0" O.C.
  - 3. PVC Piping - 4'-0" O.C.
  - 4. Provide 2 hangers at each change in direction.
- B. Hangers shall be the Clevis type as manufactured by Modern Fig. 590, B-Line Fig. B 3100, or Grinnell Fig. 260 complete with hanger rods of size to conform to the type of hanger and pipe supported. Hangers shall be attached to the building by beam clamps or bolted to bar joist. At

hangers provide 16" long 16 gauge galvanized sheet metal protection saddle three times the nominal pipe diameter. Under no condition shall hangers be connected directly to insulated pipe. Saddles shall be Modern Type A, B-Line Fig. B 3151, or Grinnell Fig. 167.

- C. Hangers for vertical piping shall be riser clamp design as manufactured by Modern Fig. 500, B-Line Fig. B3373 or Grinnell Fig. 261. Riser clamps shall be installed on top of each floor penetration.
- D. Condensate and refrigerant piping on roof shall be supported by EPDM rubber bases with integral pipe securement. Support shall be OMG PGM, PGS, PGTS -BK or approved equal. Walk pads under each support shall be appropriate for roof per roof's warranty requirements.

#### **230515 INSULATION**

- A. All piping and ductwork shall be inspected and tested before insulation is applied. All insulation shall meet UL 723 and ASTM-E84 flame spread and smoke developed requirements of 25/50 and shall comply with NFPA 90A and the latest edition of the NC Building Code. Insulation shall be Certainteed, Owen Corning, Knauf, and Johns-Manville.
- B. All air conditioning supply, return, relief/exhaust, and outside air ducts concealed above a ceiling and the back of all diffusers and grilles shall be externally insulated with 2" thick 1 lb. density foil scrim kraft jacketed insulation. Adhere insulation to duct with fire retardant adhesive in sufficient quantities to prevent sagging. Ducts with a width over 30" shall be further secured on all sides with mechanical fasteners on 18" maximum centers. Insulation shall be butted with facing overlapping all joints at least 2" and sealed with fire retardant vapor barrier adhesive. Tape all joints, breaks, punctures, and any penetrations with SMACNA foil faced kraft duct tape.
- C. Where externally insulated ductwork is supported by angles, provide 6" long x duct width x 1-1/2" thick 6.0 pound density board insulation on bottom of duct at hanger support. External duct insulation shall be continuous around ductwork and board insulation at duct hanger. On round ducts, duct hanger shall be outside duct insulation.
- D. Air handling unit drain pan condensate piping on interior and pumped condensate piping shall be insulated with tubular closed cell elastomeric insulation with all joints butted and cemented tight. Insulation on interior condensate piping shall be 1" thick.

#### **230516 SPECIALTIES**

- A. Floor, wall and ceiling plates or escutcheons of size to fit pipe covering shall be installed where pipes pass thru finished areas and shall be chromium plated spring type as manufactured by Kenney, Connecticut Stamping and Bending Company, Dearborne or approved equal.
- B. Unions or flanges shall be provided throughout the piping system to facilitate the removal and servicing of all valves, equipment, items, etc.

#### **230517 VIBRATION ISOLATION**

- A. Pad type isolators shall be 3/4" thick bridge bearing quality neoprene ribbed or waffled on both sides. Pads shall be selected for a maximum durometer of 50 and designed for 15% deflection. Where required, steel load-spreading plates shall be incorporated between the equipment and the neoprene pad.
- B. Flexible duct connections, both at inlet and discharge of units, shall be made of 30 oz. workinglass fiber coated with neoprene, sewn together at edges and joints. These flexible connections shall withstand the operating air-pressure, shall not permit air leakage, and shall not transmit vibration.

#### **230518 OPENINGS**

- A. The Heating and Air Conditioning Contractor shall furnish all blockouts, sleeves, and openings required for his work. Pipe sleeves, where firestop penetration system allows, shall be standard weight black steel pipe and shall be provided where pipes pass through walls and floor. Sleeves through walls shall butt flush with the wall finish and shall be of sufficient size to permit passage of pipe covering through the area where pipe is installed. Sleeves through floors shall extend

3/4" above the finished floor and sealed watertight. Any penetrations of ducts through floor shall be curbed 3" high x 6" wide with concrete. Specifically inform the General Contractor as to the correct size and location of openings and sleeves to ensure that they shall be cast in their proper location. Sleeves and duct opening frames shall be furnished and installed by the Heating and Air Conditioning Contractor. Failure to indicate such openings in time to avoid delaying the General Contractor shall result in the Heating and Air Conditioning Contractor providing all cutting and repairing at his own expense. Repairing shall include sealing tight around pipe sleeves and duct frames in a neat and professional manner and in accordance with the "Cutting and Patching" section of this specification.

- B. All penetrations in rated floors, firewalls and any other rated separations shall be protected using a through-penetration firestopping method with an "F" rating equivalent to the rating of the membrane being penetrated for particular piping materials used and membrane construction type. Floor penetrations shall additionally have a "T" rating equivalent to the rating of the floor being penetrated. Through-penetration firestop systems shall be installed and tested in accordance with ASTM E814 or UL 1479.

#### **230519 COLOR CODING/PAINTING**

- A. All exposed mechanical equipment in finished areas including ductwork, piping, hangers, etc., shall be painted the same color as the adjacent ceiling and walls by the General Contractor. Heating and Air Conditioning Contractor shall treat all items as necessary to receive paint.

#### **230520 PIPE MARKERS**

- A. Markers shall have wording, wording colors, and wording background in accordance with ANSI A13.1. Markers shall have letters approximately 1" high on appropriate background, flow arrows, and shall be located on the pipe at least once in every space and at intervals not exceeding 10'-0" where in mechanical spaces and 25'-0" intervals where above ceilings. Markers shall be plastic with markers on piping completely encircling the pipe with overlap and permanent tension in the marker to grip the pipe firmly with the need of adhesives. Provide markers on all piping in the building. Wording of markers shall be as follows:
  - 1. Refrigerant - **"WARNING – Risk of Fire – Flammable Refrigerant"**
  - 2. Condensate.

#### **230521 NAMEPLATES**

- A. All packaged heat pumps, split systems, power ventilators, and heaters shall be furnished with engraved plastic laminated labels permanently attached to the equipment. Lettering shall be 1/2" tall. Label shall include equipment number, area served, final acceptance date, number and size of filters, number and size of belts, and capacities. Final acceptance date shall be on a separate label so as to allow equipment nameplates to be installed prior to final acceptance.
- B. Provide master list for all HVAC equipment:
  - 1. Equipment listing shall be identified with same mark and number as on the drawings.
  - 2. Listing shall include location of equipment by room number.
  - 3. Listing shall include area served by each piece of equipment.
  - 4. Listing shall include size, quantity, and location of filters for each piece of equipment.
  - 5. Include in listing schedule for access doors with item accessed, item location, and area served indicated in schedule, see Article 230513 Access Doors.
  - 6. Provide drawing showing equipment and location on roof plan(s) and separate plan(s) with rooms, including room names and numbers.
  - 7. List and drawings shall be printed single-sided and shall be laminated.
  - 8. Provide in Maintenance Manual.

#### **230522 CUTTING AND PATCHING**

- A. The Heating and Air Conditioning Contractor shall do all cutting and patching necessary to install all equipment as required under his contract in accordance with the General Conditions of these specifications and shall re-establish all finishes where cutting and patching occur to their original condition. All cutting of the structure, where unavoidable, must be approved by the Engineer and

be done by the General Contractor, but shall be paid for by the Heating and Air Conditioning Contractor.

**230523 PIPING PRESSURE TESTING**

- A. The Heating and Air Conditioning Contractor shall make the following tests of the systems before they are insulated or covered by construction. The systems shall have no decrease in pressure during the test periods. All system components shall be protected from test pressures that exceed manufacturer's design limits.
- B. Notify Architect, Engineer, and Commissioning Authority 48 hours in advance of all tests.
- C. Heating and Air Conditioning Contractor shall provide written report of each test.
- D. Refrigerant piping shall be tested in accordance with Chapter 11 of the North Carolina Mechanical Code and split system unit manufacturer's recommendations.
- E. Condensate piping shall be tested by applying a hydrostatic pressure of 100-psig for a period of two hours.
- F. No caulking of joints shall be permitted. Any joint found to leak under this test shall be broken, remade, and a new test applied. Welded joint pinhole leaks shall be repaired by welding; however, welds that show numerous pinholes shall be replaced.

**230524 TESTING AND BALANCING**

- A. Testing and balancing of heating, ventilating, and air conditioning systems shall be performed and certified by an independent Test and Balance Contractor as a subcontractor to the Heating and Air Conditioning Contractor. All instruments used shall be accurately calibrated and in good working order. The Test and Balance Contractor shall test in strict accordance to the Standards of AABC or NEBB.
- B. Air balance and testing shall not begin until the systems have been installed in full working order and shown to be operating satisfactory on both heating and cooling. The Contractor shall place all heating, ventilating, and air conditioning systems into full operation and shall continue operation of the system until balancing is completed. All operational cost shall be borne by the Heating and Air Conditioning Contractor. The Architect and Engineer shall be given three weeks advance notice of when tests are to be made.
- C. Upon completion of the heating, ventilating, and air conditioning systems, the Test and Balance Contractor shall compile the test data and submit four copies of the completed test data to the Engineer for evaluation and approval. At final inspection, Heating and Air Conditioning Contractor shall have a copy of test and balance report and all necessary personnel and equipment to facilitate spot-checking of test and balance data by the Engineer or his representative. Final payment to the Contractor shall be withheld until the complete test and balance data has been approved.
- D. Testing Procedure (AIR):
  - 1. Test and adjust air handling unit fan's RPM and CFM to design requirements. Record all data.
  - 2. Test and record motor full load amperes on all motors.
  - 3. Check and record coil leaving air temperatures from coils when in full cooling, full heating, and from full hot gas reheat coil.
  - 4. Adjust all main supply, exhaust, return, relief, and outside air ducts to proper design CFM when air handling systems are in normal operating mode, and in outside air economizer mode. Record exhaust, relief, and outside air data for each mode of operation.
  - 5. Test and adjust each diffuser, grille, and register for supply, exhaust, or return systems to within 10% of design requirements. Record all data.
  - 6. All adjustments to air diffusing devices where possible shall be made in trunk or run out dampers, not at diffuser volume control.
  - 7. Exhaust fans shall be tested and balanced for the requirement as shown on the plans. Record all data.

8. The Heating and Air Conditioning Contractor shall make any changes in the pulleys, belts, filters, dampers, or valves necessary or as recommended by the Engineer for correct balance at no additional cost to the Owner.

#### **230525 INSTRUCTIONS/TRAINING**

- A. The Heating and Air Conditioning Contractor shall give an instruction and training period in the operation of the apparatus to the persons who will be in charge of the system. See Section 017900 for listing and training requirements.

#### **230526 MAINTENANCE DATA**

- A. For all items requiring maintenance, the Heating and Air Conditioning Contractor shall furnish two weeks prior to Final Acceptance and deliver to the Owner's representative on the job multiple copies of complete data as prepared by the manufacturer covering the details of operation and maintenance and complete parts list for all equipment specified. Each copy of the maintenance data shall be assembled into a 3-ring hardback binder with indexing and label on cover and spine. Data shall include:
  1. Index with page numbers.
  2. List of all subcontractors and suppliers with names, addresses, and phone numbers.
  3. Contractor's certificate of Final Acceptance.
  4. Copy of all warranties.
  5. Equipment model numbers, etc. indicated and referenced with the same mark as shown on equipment on the drawings.
  6. Filter schedules of sizes and quantities for all equipment requiring filters referenced by mark on the drawings.
  7. Equipment summary showing all capacities and ratings.
  8. Certified test and balance report.
  9. Start-up and test reports for equipment.
  10. Complete start-up, operation, and shut-down procedures for each system.
  11. Lubrication schedules and types of lubricates.
  12. All submittal data and shop drawings, unless included in a separate manual.
  13. See Section 017823 for additional requirements.

#### **230527 RECORD DRAWINGS**

- A. In accordance with Section 017839 Project Record documents, the Heating and Air Conditioning Contractor shall maintain "during the course of the work" a set of specifications and drawings marked up to show the work as installed, **including a minimum of two dimensions to indicate locations and elevations of buried work**. Upon completion of the work, return this set of drawings to the Architect.

#### **230528 GUARANTEE**

- A. The Heating and Air Conditioning Contractor shall guarantee the entire heating and air conditioning systems subject to the General Conditions of these specifications, except where additional or extended warranty requirements are noted elsewhere in the articles within Section 230500.

**END OF SECTION**

**SECTION 23 0900**  
**INSTRUMENTATION AND CONTROL FOR HVAC**

**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 DESCRIPTION OF WORK**

- A. Furnish and install an electric control system to fulfill the intent of the drawings and specifications. The systems shall include all necessary labor, electrical wiring, controllers, programmable sensors for temperature and relative humidity, zone and bypass dampers, devices, and materials for a complete installed control system. The control system shall be erected, assembled, and installed by factory-trained mechanics regularly employed by the control manufacturer or manufacturer's authorized distributor as a subcontractor to the Heating and Air Conditioning Contractor. All equipment, unless specified to the contrary, shall be fully proportional and shall be the product of the control manufacturer.
- B. The control diagrams indicated on the drawings or specified herein show the intended sequences of operation of the various control systems and shall be followed as closely as practicable. All required devices and control schemes may not be shown on the drawings. It is the Contractor's responsibility to provide all devices and control schemes whether shown or not.
- C. Additional General Requirements for Controls:
  - 1. All wiring, conduit, and panels for all temperature controls.
  - 2. Power required for controls shall be provided by the Controls Contractor from points coordinated with the Electrical Contractor.
  - 3. Perform all wiring in accordance with all local and national codes and Division 26 of these specifications.
  - 4. Surge transient protection shall be incorporated in the design of the system to protect electrical components in all system components as described below under "General Product Description."
  - 5. System modifications necessary to fine-tune sequences during commissioning of systems at no additional cost to the Owner.
  - 6. Mount control devices inside of a UL-listed steel enclosure panel, with hinged locking cover and key locking latch.
- D. Wiring and Controls:
  - 1. Control Contractor shall be responsible for the installation and wiring of temperature controls, control interlock wiring, electrical controls and devices in the temperature control system.

**1.3 QUALITY ASSURANCE AND STANDARDS**

- A. Materials and equipment shall be the cataloged products of manufacturers regularly engaged in production and installation of integrated control systems and shall be manufacturer's latest standard design that complies with the specification requirements.
- B. All products used in this project installation shall be new and currently being manufactured. This installation shall not be used as a test site for any new products. Spare parts shall be available for at least five years after completion of this contract.
- C. Install system using competent workmen who are fully trained in the installation of integrated control systems.
- D. Single source responsibility of Contractor shall be the complete installation and proper operation of the control system and shall include debugging and proper calibration of each component in the entire system.

- E. Contractor shall have an in-place support facility within 100 miles of the site with technical staff, spare parts inventory and all necessary test and diagnostic equipment.
- F. The Contractor and manufacturer representative shall support the installed system for a minimum of 1 year. The support shall provide full material warranty of controllers and 8 hours of on-site training.
- G. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Section 15, governing Radio Frequency Electromagnetic Interference and be so labeled.
- H. Design and build all system components to be fault-tolerant.
  - 1. Satisfactory operation without damage at 110% and 85% of rated voltage and at plus 3-Hertz variation in line frequency.
  - 2. Static, transient and short-circuit protection on all inputs and outputs.
  - 3. Protect communication lines against incorrect wiring, static transients and induced magnetic interference.
  - 4. Network-connected devices to be A.C. coupled or equivalent or that any single device failure will not disrupt or halt network communication.
  - 5. All real time clocks and data file RAM to be battery-backed for a minimum 72 hours and include local and system low battery indication.
  - 6. All programs shall retain their memory for a minimum of 7 days upon loss of power.
- I. Comply with NFPA 90A, Standard for Installation of Air Conditioning and Ventilating Systems.
- J. Provide wiring in accordance with NEC requirements and Division 26 of these Specifications.

#### **1.4 SUBMITTALS**

- A. Product Data: Submit copies of manufacturer's technical product data for each control device furnished. Indicate dimensions, capacities, performance, electrical characteristics, material finishes; also include installation and start-up instructions.
- B. Shop Drawings: Submit copies of shop drawings for each control system, containing at least the following information:
  - 1. Schematic flow diagram of system showing fans, pumps, coils, dampers, valves, control devices and all interconnections between devices.
  - 2. Indicate all required electrical wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
  - 3. Written description of sequence of operation.
- C. Number of copies of Product Data and Shop Drawings shall be per Division 1 of these Specifications.

#### **1.5 DELIVERY, STORAGE AND HANDLING**

- A. Provide equipment and control devices in factory shipping carton. Maintain in cartons while shipping, storing and handling as required to prevent equipment damage and to keep dirt and moisture from equipment. Store equipment and materials inside and protect from weather.

### **PART 2 - PRODUCTS**

#### **2.1 PRODUCTS**

- A. Building controls, controllers, and communications between devices shall be provided as necessary to achieve specified sequences of operation.
- B. Room sensors shall be combination heating, cooling and relative humidity sensors and shall be programmable, digital, low voltage, automatic changeover, dual setpoint type with the configuration/programming be stored in non-volatile memory or by battery backup, key pad lockout, temporary program override, temperature warmer/cooler adjustment, and night temperature setback control.
  - 1. Temperature control shall have heat anticipation, fan on-off switch, multi-stage cooling control and multi-stage heating control to match units controlled.
  - 2. Humidity control sensors shall be thin-film capacitive type sensor with on-board nonvolatile memory, accuracy to plus or minus two percent (2%) at 0 to 90% RH, 12 - 30

- VDC input voltage, analog output (0 - 10 VDC or 4 - 20mA output). Operating range shall be 0 to 100% RH and 32 to 140 degree F.
3. Space mounted sensors shall have LCD display.
  4. Sensors shall have all capabilities to satisfy the sequences of operation as specified.
  5. System will not be DDC type but room sensors shall be wi-fi connected so that Pender County Maintenance can remotely monitor and make changes to the HVAC system as necessary.
- C. Motor operated control dampers for control of outside air and/or return air that will not be integral to the equipment shall be furnished by the Control System Contractor. See Section 230500 for specification of motor operated control dampers.
  - D. Control damper actuators shall be furnished by the Control System Contractor. Two-position or proportional electric actuators shall be direct-mount type sized to provide a minimum of 5 in-lb torque per square foot of damper area. Damper actuators shall be spring return type. Operators shall be heavy-duty electronic type for positioning automatic dampers in response to a control signal. Motor shall be of sufficient size to operate damper positively and smoothly to obtain correct sequence as indicated. All applications requiring proportional operation shall utilize truly proportional electric actuators.
  - E. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point. Current switch to include an integral LED for indication of trip condition and a current level below trip set point. Manufacturer: Veris, or approved equivalent.
  - F. Relays: Start/stop relay model shall provide either momentary or maintained switching action as appropriate for the motor being started. All relays shall be plugged in, interchangeable, mounted on a subbase and wired to numbered terminals strips. Relays installed in panels shall all be DPDT with indicating lamp. Relays installed outside of controlled devices shall be enclosed in a NEMA enclosure suitable for the location. Relays shall be labeled with UR symbol. RIB-style relays are acceptable for remote enable/disable.
  - G. Control Power Transformers: Provide step-down transformers for all DDC controllers and devices as required. Transformers shall be sized for the load, but shall be sized for 50 watts, minimum. Transformers shall be UL listed Class 2 type, for 120VAC/24VAC operation.
  - H. Line voltage protection: All control system panels that are powered by 120 VAC circuits shall be provided with surge protection. This protection is in addition to any internal protection provided by the manufacturer. The protection shall meet UL, ULC 1449, IEEE C62.41B. A grounding conductor, (minimum 12 AWG), shall be brought to each control panel.
  - I. Condensate Level Sensor shall be plenum-rated water level detection device, conforming to UL 508, consisting of one or more moisture sensors and a NO dry contact to serve as a binary input point connected to the unit's controls to disable mechanical cooling in the event the condensate drain is blocked. Device shall be mounted in the unit's auxiliary drain pan located at the lowest possible level in the auxiliary drain pan. Sensor shall be retained by clips and adhesive tape.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION - GENERAL**

- A. Install systems and materials in accordance with manufacturer's instructions in a neat workmanlike manner.
- B. Coordinate with other trades on the project as the work progresses so that each will be aware of the extent of all work. Carefully plan all work and check for interferences before installation. No extras will be allowed for changes caused by failure to check for interferences.
- C. Provide structural supports as required for panels and control devices.
- D. Supervise installation of all control dampers.

- E. Install metering devices away from bends and elbows with minimum upstream and downstream straight distances per manufacturer's recommendations and as shown on Drawings.

### **3.2 CONTROL WIRING**

- A. Install color-coded control wiring without splices between terminal points in accordance with National Electrical Code in accordance with the Electrical Division, Division 26, of these specifications.
- B. Install circuits over 25 volts with color-coded No. 12 or 14.
- C. Install circuits under 25 volts with color-coded cable as recommended and approved by the manufacturer.
- D. All wiring and cable used shall be plenum rated.
- E. Wiring above hard ceilings, in walls, or where exposed including in mechanical rooms shall be in 3/4" minimum EMT conduit with steel-plated hexagonal compression connectors. Wiring above lay-in ceilings may be installed as properly supported cable. Flexible metallic conduit shall be 1/2" minimum in size and not exceed 3'-0" in length.
- F. All wiring in floor slabs or on exterior shall be run in rigid conduit.

### **3.3 TESTING**

- A. When installation of the control system is complete, calibrate equipment and verify transmission media operation before the system is placed on-line.
- B. Provide a cross check of each control point within the control system by making a comparison between the control command and the field-controlled device.
- C. Replace any work found defective. After replacement, repeat test.

### **3.4 START-UP AND DEMONSTRATION**

- A. After completion and testing of the installation, regulate, adjust and service as necessary all control devices in the systems, placing each item in complete and proper operation.
- B. Demonstrate all systems to Owner, Architect and Engineer, and that all are operable from local controls in the specified failure mode upon electronic control system failure or loss of power.
- C. Complete all commissioning requirements as necessary to this scope of work.

### **3.5 INSTRUCTION**

- A. Provide the services of manufacturer's technical personnel for 8 hours of instruction to Owner's personnel in the operation, maintenance and programming of the control system. Orient the training specifically to the system installed rather than a general training course.
- B. Provide training manuals, equipment and material required for classroom training.
- C. Training to include the following items:
  - 1. Operation of equipment
  - 2. Programming
  - 3. Diagnostics
  - 4. Failure recovery procedures
  - 5. Alarm formats (where applicable)
  - 6. Maintenance and calibration
  - 7. Trouble shooting, diagnostics, and repair instructions

## **PART 4 - POINTS LISTS AND SEQUENCES OF OPERATION**

### **4.1 SUMMARY**

- A. The drawings indicate the individual types of systems and the points required in each system.
- B. System sequences of operation shall be as indicated on the drawings and as specified herein.

### **END OF SECTION**

**SECTION 26 0000**  
**ELECTRICAL, BASICS**

**1.1 RELATED DOCUMENTS**

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

**1.2 GENERAL**

- A. Applicable requirements of any Instructions to Bidders, General Conditions of the Contract, and/or Supplemental Conditions shall be a part of the Electrical Specifications. The electrical contractor shall examine all contract documents before submitting a proposal.
- B. The electrical work shall be performed by an electrical contractor, suitably licensed for the scope of work of this specific project.
- C. The electrical contractor shall assume total responsibility for any portion of the work provided by his subcontractors.

**1.3 CODES AND STANDARDS**

- A. Building Codes:
  - 1. National Fire Protection Association No. 70, National Electrical Code (NEC)
  - 2. National Fire Protection Association No. 72, National Fire Alarm and Signaling Code
  - 3. North Carolina State Building Code, Latest Edition and Revisions (NCSBC)
  - 4. North Carolina State Fire Code, Latest Edition and Revisions
  - 5. National Electrical Safety Code (NESC)
  - 6. National Bureau of Standards (NBS)
  - 7. Local Codes where applicable
- B. Industry Standards:
  - 1. Underwriter's Laboratories, Inc. Standards and approved listings (UL)
  - 2. Electrical Testing Laboratories Standards (ETL)
  - 3. National Electrical Manufacturers Association Standards (NEMA)
  - 4. Insulated Power Cable Engineers Association Standards (IPCEA)
  - 5. American National Standards Institute (ANSI)
  - 6. American Society for Testing Materials Standards (ASTM)
  - 7. Canadian Standards Association (CSA)

**1.4 QUALITY ASSURANCE**

- A. Electrical materials, equipment, devices, fixtures, etc. shall be listed and labeled by a third-party agency that is accredited by the NCBCC (North Carolina Building Code Council) to label electrical & mechanical equipment. Listing and labeling shall comply with NC Department of Insurance requirements as detailed in NC General Statutes 66-23 through 66-25. This paragraph applies to all electrical specification sections under specification divisions 26, 27, and 28.

**1.5 SCOPE OF WORK**

- A. It is the intent and meaning of the drawings and specifications to call for finished work that has been tested and is ready for operation. The electrical contractor shall take this into consideration and include in his proposal allowance for contingencies that will allow him to provide minor pieces of materials and labor not specifically indicated but required for the job to operate properly. This paragraph is intended to insure that a complete job will be provided without requests for minor extras.
- B. It shall be understood that where the words "furnish," "provide," and/or "install" are used, it is intended that this CONTRACTOR shall purchase and install completely all material necessary and required for this particular item, system, equipment, etc.

## **1.6 ELECTRICAL SERVICE**

- A. The electrical contractor shall be totally responsible for coordination with the Utility Company and assistance to the OWNER to obtain a permanent electrical service for the structure. He shall act as coordinator between the Utility Company and the OWNER and shall supply the Utility Company with equipment characteristics, load data, etc. Any installation, connection, underground service or special fees charged by the Utility Company for the new service shall be paid by the OWNER. Construction and testing power shall be paid for as described in the General Conditions of the project manual.
- B. Electrical service to the structure shall be 120/208 volts, 3 phase, 4 wire.
- C. The electrical contractor shall coordinate the electrical service, metering and metering equipment with the local utility company for arrangements, locations, connections, etc.
- D. Utility transformer pads shall be installed by the electrical contractor. Coordinate equipment pad requirements with the local utility company.
- E. Current transformer cabinets and self-contained meter cabinets shall be installed by the electrical contractor, unless directed otherwise by the Utility Company. Coordinate metering requirements with the Utility Company before rough-in of service raceways.
- F. The electrical service entrance raceways shall be installed by the electrical contractor and sized as shown on the contract drawings, or as required by the Utility Company. Service entrance conductors will be provided and installed by the Utility Company to the line side of the metering equipment. Service entrance conductors from the metering equipment to the service equipment shall be provided by the electrical contractor. Load side connections shall be made by the electrical contractor.

## **1.7 RECORD DRAWINGS**

- A. A set of drawings covering the electrical contract will be provided to the electrical contractor to mark in color all changes, modifications, or revisions effected during construction. These field mark-up drawings are to be turned over to the electrical designer.
- B. The electrical contractor shall provide final installed photographs of switchboards and panelboards. Photographs shall clearly show equipment designations, manufacturer nameplates, breaker positions, breaker ratings, and directory descriptions.

## **1.8 APPROVAL OF MATERIALS**

- A. Construction phase: The CONTRACTOR shall submit his proposal on the specified materials and equipment, or their equivalent, provided the words "or equal" or "or approved equal" follow the named manufacturers. If the above phrases do not appear, the specified manufacturers shall be furnished without substitution. Equivalent shall be interpreted to mean an item of material or equipment, similar to that named and which is suitable for the same use and capable of performing the same functions as that named, with the Design Team being the judge of equality.
- B. Where no specific material or equipment type is mentioned, any first-class product of a reputable manufacturer may be used provided it conforms to the requirements of the specifications.

## **1.9 SHOP DRAWINGS AND SUBMITTAL DATA PROCEDURES**

- A. The CONTRACTOR shall submit PDF files of shop drawings, certified prints, literature, and product data sheets to the Design Team for all major items of equipment and materials for review and approval. It is preferred that all electrical submittals for the project shall be submitted at one and the same time.
- B. Product data sheets with multiple components, part numbers, etc. shall be clearly marked or highlighted to identify what specific product/model/part number/component is proposed for this project. All instances of the proposed part number components in the product data shall be marked or highlighted throughout product data sheets submitted.

- C. The CONTRACTOR shall analyze all shop drawings and submittal data and certify that they meet requirements of Contract Drawings and Specifications, prior to delivery to the Design Team. CONTRACTOR Certification shall be in the form of suitable approval stamp placed on each shop drawing/submittal submitted.
  - 1. If the shop drawings or submittal data deviate from the Contract Documents, the CONTRACTOR shall advise the Design Team of deviations in writing, accompanying the shop drawings and submittal data, including the reason for deviations.
- D. If the Design Team deems submittal data is either incomplete or incorrect, a resubmittal will be required. Where a resubmittal is not necessary but confirmation of receipt of review comments is requested, confirmation shall be submitted in writing.
- E. At least one set of all final submittal data, shop drawings, certified prints, etc., shall be maintained at the job site and available to representatives of the Design Team.
- F. Approval by the Design Team of shop drawings and submittal data is for general conformance with the contract documents and design concept.
  - 1. Such approval does not relieve the CONTRACTOR of responsibility for compliance with the project drawings and specifications.
  - 2. Such approval for any materials, apparatus, devices, and layouts shall not relieve the CONTRACTOR from the responsibility of furnishing same of proper dimensions, size, quantity, quality and all performance characteristics to efficiently complete the requirements and intent of the contract documents.
  - 3. Such approval shall not relieve the CONTRACTOR from responsibility for errors of any sort on the shop drawings.
- G. Physical sizes of equipment used in the design layout are those of reputable equipment manufacturers. The CONTRACTOR is responsible for providing equipment that will fit the space available. If the CONTRACTOR elects to use equipment that results in conflicts with space clearance or codes, it shall be the responsibility of the CONTRACTOR to correct at his expense. The CONTRACTOR shall be responsible for providing code clearances. Where equipment is designated for existing space, the CONTRACTOR shall make necessary field measurements to ascertain space requirements, including those for connections; and shall furnish and install such sizes and shapes of equipment that the final installation shall suit the intent and meaning of the drawings and specifications.
- H. Catalog Data for OWNER
  - 1. The CONTRACTOR shall provide compilations of catalog data, bound in suitable loose-leaf binders, for each manufactured item of equipment used in the electrical work. These shall be presented to the Design Team for transmittal to the OWNER before the final inspection is made. Data shall include printed installation, operation, and maintenance instructions for each item, indexed by product with heavy sheet dividers and tabs. All warranties shall be included with each item. Each manufacturer's name, address, and telephone number shall be clearly indicated. Generally, shop drawings and submittal data alone are not adequate for catalog data.
- I. Record Documents for OWNER
  - 1. Conductor and cable megger test results.
  - 2. Field mark-up as-built drawings.
  - 3. Grounding electrode system test results.
  - 4. Circuit breaker trip settings.
  - 5. Generator start-up test results.
  - 6. Automatic transfer switch settings.
  - 7. Communications backbone cable:
    - a. Test results.
    - b. Cable schedule.
    - c. Cable administration drawings.

8. Communications horizontal cable:
  - a. Test results.
  - b. Cable schedule.
  - c. Cable administration drawings.
9. Fire alarm system:
  - a. NFPA 72 Fire Alarm System Record of Completion.
  - b. System Status and Programming Report.
  - c. System operational matrix.
  - d. Digital copy of system software on USB flash drive.
10. Emergency responder radio coverage system:
  - a. Documentation of system acceptance by the local Fire Marshal / AHJ.
  - b. RF Survey / Shop Drawings: Final installed measurement drawings of each floor of the building which indicate relative RF field strength for each frequency and band of interest.
11. Warranty documents.

#### **1.10 DRAWINGS AND SPECIFICATIONS**

- A. The Electrical drawings and specifications are complementary each to the other, and what may be called for by one shall be as binding as if called for by both. The drawings are diagrammatic and indicate generally the location of outlets, devices, equipment wiring, etc and show the general arrangement of raceways, fixtures, and equipment. Drawings shall be followed as closely as actual building construction and the work of other trades will permit; however, all work shall suit the finished surroundings and/or trim.
- B. Any omission from either the drawings or the specifications are unintentional, and it shall be the responsibility of the CONTRACTOR to call to the attention of the Design Team any pertinent omissions before submitting a proposal. Complete and working systems are required, whether every small item of material is shown and specified or not.
- C. The electrical work shall conform to the requirements shown on all of the drawings. General and Structural drawings shall take precedence over Electrical Drawings. Because of small scale of the electrical drawings, it is not practical to indicate offsets, fittings and accessories that may be required. The CONTRACTOR shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly, providing such fittings and accessories as may be required to meet such conditions, without additional cost to the OWNER and as directed by the Design Team.
- D. Load circuits shall be installed as indicated on the drawings. Circuit number revisions will not be accepted unless approved in writing by the Engineer.

#### **1.11 COORDINATION OF WORK**

- A. It is understood and agreed that by submitting a proposal, the CONTRACTOR has, by careful examination, satisfied himself as to the nature and location of the work, the conformation of the ground, the character, quality and quantity of the materials to be encountered, the general and local conditions and all other matters which can and may affect the work under this contract. The CONTRACTOR shall be held responsible for visiting the site and thoroughly familiarizing himself with the existing conditions and also any contractual requirements as may be set forth in other divisions of the specifications and in other contract documents. No extras will be considered because of additional work necessitated by obvious job conditions that are not indicated on the drawings.
- B. The CONTRACTOR shall compare the electrical drawings and specifications with the drawings and specifications for other trades and shall report any discrepancies between them to the Design Team. If needed, request from the Design Team written instructions for changes necessary in the electrical work. The electrical work shall be installed in cooperation with other trades installing interrelated work. Before installation, the CONTRACTOR shall make proper provisions to avoid interferences in a manner approved by the Design Team. All changes

required in the work of the CONTRACTOR caused by his neglect to do so shall be made by him at his expense.

- C. Location of electrical raceways, switches, panels, equipment, fixtures, etc., shall be adjusted to accommodate the work to interferences anticipated and encountered. The CONTRACTOR shall determine the exact route and location of each electrical raceway prior to make up and assembly.
- D. Right-of-Way: Lines which pitch shall have the right-of-way over those which do not pitch. For example; steam, condensate and plumbing drains shall normally have right of way. Lines whose elevations cannot be changed shall have the right of way over lines whose elevations can be changed.
- E. Offsets and changes in direction of electrical raceways shall be made as required to maintain proper headroom and to clear pitched lines whether or not indicated on the drawings. The CONTRACTOR shall furnish and install elbows, pull boxes, etc., as required to affect these offsets, transitions, and changes in directions. Conflicts between electrical raceways, fixtures, etc., and ductwork which cannot be resolved otherwise, will be resolved by the Design Team.
- F. The CONTRACTOR shall install all electrical work to permit removal (without damage to other parts) of any equipment requiring periodic replacement or maintenance. The CONTRACTOR shall arrange electrical raceways and equipment to permit ready access to valves, cocks, traps, starters, motors, control components, etc., and to clear the opening of swinging and overhead doors and of access panels.
- G. Work at Existing Facilities:
  - 1. Where work may be required to be performed at existing and/or occupied facilities, such work shall be scheduled and arranged to be done at the convenience of the OWNER so as not to interfere with, disrupt, or disturb normal operations at the facilities. The CONTRACTOR shall obtain written approval from the OWNER before proceeding with work at existing facilities and shall work at existing facilities on schedule as agreed upon with the OWNER. This is not to be necessarily construed to mean that the CONTRACTOR is expected to perform work at existing facilities on holidays, weekends, etc., but that the Contractor must schedule work with the OWNER for the OWNER's beneficial and normal usage of the facilities, and that the CONTRACTOR will be required to maintain the schedule as approved by the OWNER.
  - 2. The CONTRACTOR shall, at all times, provide safety barriers, protective devices, screening, dust barriers, etc., as required to maintain the safety and comfort of the building's personnel and/or occupants in or near his work area.
  - 3. The CONTRACTOR shall be responsible for cleanup in connection with his work at existing facilities. At the end of each working day, all debris, boxes, waste, etc. shall be removed from the facilities and properly disposed of. Equipment, materials, etc. may be left inside the facilities, but such must be properly stored, stacked, and located as approved by the OWNER.
  - 4. The CONTRACTOR shall do all cutting, patching, finishing, repairing, painting, etc., necessary for electrical work to be installed at existing facilities. All finishes shall be left to equal finish and condition prior to cutting. No cutting of structural members will be allowed. All cutting of walls, floors, roofs, etc. shall be repaired and/or replaced to a finish equal to that found prior to cutting.
  - 5. The CONTRACTOR shall route conduits and locate equipment as approved by the OWNER and Design Team. Routing and locations shall be firmly established and approved before proceeding with any phase of the work.
  - 6. The CONTRACTOR shall be responsible for any and all damage to the existing facilities, grounds, walkways, paving, etc. caused by the work, the CONTRACTOR and/or his personnel, and/or his equipment in the accomplishment of this work. Such damages shall be repaired and/or replaced by the CONTRACTOR at his expense, to equal finish prior to damage. The Design Team shall be the judge as to equal finishes, etc.
  - 7. Certain power requirements must be met without interruption during certain times on the existing electrical system. It is anticipated that partial power outages will be necessary to

accomplish the work covered by these drawings and specifications. The CONTRACTOR shall determine in advance the dates, times and duration of these outages and shall obtain permission from the OWNER to shut down the electric power. Unauthorized power outages will not be tolerated.

H. Equipment and Materials (General):

1. Materials shall be new and shall bear the manufacturer's name, trade name, and listing label in every case where a standard has been established for the particular material. The equipment to be furnished under this specification shall be essentially the standard product of manufacturers regularly engaged in the production of the required type of equipment and shall be the manufacturer's latest approved design.
2. Electrical motors shall meet the minimum efficiency requirements identified in the Code of Federal Regulations 10 CFR Part 431.
3. Delivery and Storage:
  - a. Store products to allow for inspection and measurement of quantity or counting of units.
  - b. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
    - 1) Electrical equipment shall be delivered to the site and stored in original containers. Store protected from the elements, but readily accessible for inspection by the Design Team until installed. Equipment shall be tightly covered and protected against dirt, water and chemical or mechanical injury and theft. Corrosion inhibitors shall be installed in all panelboards, switches, starters and control panels immediately upon receipt. Install one inhibitor for every 8 cubic feet of enclosure volume. Replace inhibitors every 90 days and at final inspection in the Design Team's presence. Rusty and/or corroded materials and equipment will be replaced at the direction of the Design Team.
    - 2) Rusty and/or corroded materials and equipment will be replaced at the direction of the Design Team.
  - c. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
  - d. Protect stored products from damage.
4. Equipment and materials of the same general type shall be of the same make throughout the work to provide uniform appearance, operation and maintenance.
5. At the completion of work; fixtures, equipment, and materials shall be cleaned and polished thoroughly and turned over to the OWNER in a condition satisfactory to the Design Team. Damage or defects, developing before acceptance of the work shall be corrected at the CONTRACTOR's expense.
6. Manufacturer's directions shall be followed completely in the delivery, storage, protection, and installation of all equipment and materials. The CONTRACTOR shall promptly notify the Design Team, in writing, of any conflicts between requirements of the Contract Documents and the manufacturer's directions and shall obtain the Design Team's written instructions before proceeding with the work. Should the CONTRACTOR perform any work that does not comply with the manufacturer's instructions, recommendations, or requirements; it shall be corrected at his expense as directed by the Design Team.

I. Sleeves, Inserts, Openings, Etc.:

1. Anchor bolts, sleeves, inserts, supports, etc., that may be required for electrical work shall be furnished, located, and installed by the electrical contractor. Where working under a subcontract for a General Contractor, the electrical contractor shall give sufficient information (marked and located) to the General Contractor in time for proper placement in the construction schedule. Should the electrical contractor delay or fail to provide sufficient information in time, the electrical contractor shall cut and patch construction as

necessary and required to install electrical work, with finishes completed to the satisfaction of the the Design Team.

J. Cutting and Patching:

1. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. The electrical contractor shall be responsible for cutting and patching as required for the proper installation of electrical work for this project. Cutting shall be kept to a minimum. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Finishes shall be restored to the satisfaction of the the Design Team.

K. Locations and Measurements:

1. Outlets, equipment, fixtures, etc. are shown and located on the drawings as intended based on the Design Team's understood project scope. All measurements for installation shall be verified on the project and coordinated with the drawings of other disciplines. In all cases, work shall suit the surrounding trim and/or decoration and construction. The locations of outlets for appliances shall be installed so that when connected they permit the proper installation of appliances. Slight relocations of outlets, devices, and equipment shall be made by the electrical contractor as required or as directed by the Design Team at no additional cost to the OWNER.

L. Workmanship:

1. Work shall be executed as required by the drawings and specifications, shall be done in a workmanlike manner by skilled mechanics, and shall present a neat, trim, and mechanical appearance when completed. All work shall be performed as required by the progress of the job.

M. Final Inspections and Equipment Demonstrations:

1. The CONTRACTOR shall acquire permits for construction & coordinate all required inspections with the office of the local electrical inspector and/or local authority having jurisdiction, if required. The CONTRACTOR shall provide the Owner two (2) copies of Electrical Inspectors' written reports.
2. The CONTRACTOR shall furnish ladders, required tools, and personnel to open equipment, fixtures, boxes, panels, etc. to enable the Design Team representatives to observe any parts of the installation they may request.
3. The CONTRACTOR shall furnish meters for observation of readings as directed by the Design Team representative. Meters to be furnished include: clamp-on type ammeter, voltmeter, insulation resistance tester (i.e., often called a megger), and clamp-on type ground resistance tester.

N. Operating Instructions:

1. At the completion of the entire installation, the CONTRACTOR shall arrange to operate each component of systems and then systems as a whole. When all the requirements of the plans and specifications have been met, the CONTRACTOR shall then arrange to instruct the OWNER's operating and maintenance personnel in the correct and proper procedures for the operation and maintenance of the systems

**END OF SECTION**

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**SECTION 26 0500**  
**BASIC ELECTRICAL MATERIALS AND METHODS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Supporting devices for electrical components.
  - 2. Cutting and patching for electrical construction.
  - 3. Touchup painting.
  - 4. Firestopping
  - 5. Concrete equipment bases.
  - 6. Electricity-metering components.
  - 7. Electrical demolition.

**1.3 SUBMITTALS**

- A. Product Data:
  - 1. Support channels and hardware.
  - 2. For materials to firestop cable and raceway penetrations of fire-rated floor and wall assemblies.
- B. Shop Drawings: UL details for firestopping cable and raceway penetrations of fire-rated floor and wall assemblies.

**1.4 QUALITY ASSURANCE**

- A. Comply with NFPA 70.

**PART 2 - PRODUCTS**

**2.1 SUPPORTING DEVICES**

- A. Metal Items for Use Indoors: Plain Steel.
- B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
- C. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32 inch diameter holes at a maximum of 8 inch on center in at least one surface.
- D. Aluminum Slotted Support Systems: Preformed aluminum channels and angles with minimum 13/32 inch diameter holes at a maximum of 8 inch on center in at least one surface.
- E. Slotted Support Systems Fittings and Accessories: Products of the same manufacturer as channels.
- F. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
- G. Expansion Anchors:
  - 1. Inside: Carbon-steel wedge or sleeve type.
  - 2. Outside: Hot-dip galvanized steel wedge or sleeve type.
- H. Toggle Bolts:
  - 1. Inside: All steel springhead type.
  - 2. Outside: Hot-dip galvanized steel springhead type.

**2.2 TOUCHUP PAINT**

- A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

- B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

## **2.3 FIRESTOPPING**

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

## **2.4 CONCRETE BASES**

- A. Concrete: Unless detailed otherwise; 3000-psi, 28-day compressive strength with welded wire fabric reinforcement.

## **2.5 EQUIPMENT FOR UTILITY COMPANY'S ELECTRICITY METERING**

- A. Current-Transformer Cabinets: Comply with requirements of electrical power utility company.
- B. Meter Sockets: Comply with requirements of electrical power utility company.

# **PART 3 - EXECUTION**

## **3.1 COORDINATION**

- A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange during progress of construction to facilitate the electrical installations that follow.
  - 1. Set inserts, sleeves, raceways, boxes, etc. in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work.
- C. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces.
- D. Coordinate electrical service connections to components furnished by utility companies.
  - 1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
  - 2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.

## **3.2 ELECTRICAL EQUIPMENT INSTALLATION**

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

## **3.3 ELECTRICAL SUPPORTING DEVICE APPLICATION**

- A. Selection of Supports: Comply with manufacturer's written instructions.
- B. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb (90-kg) design load.

## **3.4 SUPPORT INSTALLATION**

- A. Install support devices to securely and permanently fasten and support electrical components.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

- D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- E. Support individual horizontal raceways with separate pipe hangers or clamps.
- F. Install 1/4-inch- diameter or larger threaded hanger rods, unless otherwise detailed.
- G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.
- H. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.
- I. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- J. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- K. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
  - 1. Wood: Fasten with wood screws or screw-type nails.
  - 2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
  - 3. New Concrete: Concrete inserts with machine screws and bolts.
  - 4. Existing Concrete: Expansion bolts.
  - 5. Steel: Spring-tension clamps on steel.
  - 6. Light Steel: Sheet-metal screws.
  - 7. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

### **3.5 FIRESTOPPING**

- A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly.

### **3.6 CONCRETE BASES**

- A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated.

### **3.7 UTILITY COMPANY ELECTRICITY-METERING EQUIPMENT**

- A. Install equipment according to utility company's written requirements. Provide grounding and empty conduits as required by utility company.

### **3.8 DEMOLITION**

- A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
- B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.

- C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches (50 mm) below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.
- D. Remove demolished material from Project site after coordination with the Owner's representative. Equipment and/or materials that the Owner desires to retain shall be moved to a location designated by the Owner's representative.
- E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

### **3.9 FIELD QUALITY CONTROL**

- A. Inspect installed components for damage and faulty work.

### **3.10 REFINISHING AND TOUCHUP PAINTING**

- A. Refinish and touch up paint.
  - 1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
  - 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
  - 3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

### **3.11 CLEANING AND PROTECTION**

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Final Acceptance.

**END OF SECTION**

**SECTION 26 0519**  
**CONDUCTORS AND CABLES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

**1.3 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Field Quality-Control Test Reports: From Contractor.

**PART 2 - PRODUCTS**

**2.1 POWER CONDUCTORS AND CABLES**

- A. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.
- B. Conductor Material:
  - 1. Copper complying with NEMA WC70 / ICEA S-95-658 solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.
  - 2. Power and lighting circuitry: Minimum conductor size shall be #12, and maximum conductor size shall be #500 kcmil.
- C. Conductor Insulation Types: Type THHN/THWN-2 complying with NEMA WC70 / ICEA S-95-658.

**2.2 CONTROL CONDUCTORS AND CABLE**

- A. Discrete control conductors: Copper, stranded, type THHN/THWN-2.

**2.3 CONNECTORS AND SPLICES**

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
  - 1. For conductors #8 & smaller, use wire-nut type twist connectors.
  - 2. For conductors #6 & larger, use pre-insulated solderless connectors with one spare port for future cable connection.

**PART 3 - EXECUTION**

**3.1 CONDUCTOR AND INSULATION APPLICATIONS**

- A. Service Entrance, Feeders, Branch Circuits: Type THHN/THWN-2, single conductors in raceway.
- B. Branch Circuits:
  - 1. Concealed in Ceilings: Type THHN/THWN-2, single conductors in raceway.
  - 2. Concealed in Walls and Partitions: Type THHN/THWN-2, single conductors in raceway.
  - 3. Exposed: Type THHN/THWN-2, single conductors in raceway.
  - 4. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- C. Discrete Control Circuits: Type THHN/THWN-2, in raceway.

**3.2 INSTALLATION**

- A. Use manufacturer-approved pulling compound or lubricant where necessary. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

- B. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables, conductors, or raceway.
- C. Identify and color-code conductors and cables according to Section "Electrical Identification".
- D. Shared neutral conductors shall not be used unless specifically indicated so on homerun circuitry designations on the drawings.

### **3.3 CONNECTIONS**

- A. Connect equipment, outlet, device, and component connections to wiring systems and to ground. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B. Where tightening torque is indicated as a numeric value on equipment or in installation instructions provided by the manufacturer, a calibrated torque tool shall be used to achieve that indicated torque value, unless the equipment manufacturer has provided installation instructions for an alternative method of achieving required torque.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

### **3.4 FIELD QUALITY CONTROL**

- A. Testing: Perform the following field quality-control testing:
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
  - 2. Inspect for physical damage. test conductors and cable for continuity and shorts.
  - 3. Insulation Resistance (Megger) testing for building wire and cable:
    - a. All current carrying 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. Insulation resistance testers shall not be electronic type. Insulation resistance testers shall be hand crank or power-driven crank type. Minimum readings between conductors and between conductor and the grounded metal raceway shall be: 25 mega-ohms for #6 wire and smaller; 50 mega-ohms for #4 wire or larger.
    - b. The CONTRACTOR shall correct malfunctioning conductors and cables, including replacement if necessary, and retest to demonstrate compliance.
    - c. Certify compliance with test parameters.
  - 4. Control / Signal Transmission Media Tests:
    - a. Test cable segments for faulty connectors, splices, terminations, and the integrity of the cable and its component parts.
    - b. Correct malfunctioning conductors and cables at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.
- B. Test Reports: Prepare a written report to record the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
  - 4. Provide tabulated insulation resistance readings for each panel circuit.
- C. Witness Tests:
  - 1. The CONTRACTOR shall furnish an insulation resistance tester and show Design Team representative and/or Owner that the conductors comply with the specified requirements.

### **END OF SECTION**

**SECTION 26 0526**  
**GROUNDING AND BONDING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

**1.3 SUBMITTALS**

- A. Product Data: For the following:
  - 1. Ground rods.
  - 2. Connection / test / inspection wells.
- B. Field Test Reports: Submit written test reports to include the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

**1.4 QUALITY ASSURANCE**

- A. Comply with UL 467.

**PART 2 - PRODUCTS**

**2.1 GROUNDING CONDUCTORS**

- A. For insulated conductors, comply with Section "Conductors and Cables."
- B. Grounding Electrode Conductors: Stranded cable.
- C. Bare Copper Conductors: Comply with the following:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Assembly of Stranded Conductors: ASTM B 8.
  - 3. Tinned Conductors: ASTM B 33.
- D. Grounding Bus:
  - 1. Bare, annealed copper bars of rectangular cross section.
  - 2. ¼" thick, 4" wide, length as required or minimum length as detailed.
  - 3. Stand-off insulator mounting brackets.

**2.2 CONNECTOR PRODUCTS**

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

**2.3 GROUNDING ELECTRODES**

- A. Ground Rods: Sectional type; copper-clad steel, ¾" diameter by 120 inches in length.
- B. Connection / Test / Inspection Wells: Provide handholes as specified below:
  - 1. Cylinder, minimum dimensions of 10" diameter x 10" deep, PVC, with cover.
  - 2. Box, minimum dimensions of 12" x 12" x 12" deep with cover, green PVC or polyethylene.

## **PART 3 - EXECUTION**

### **3.1 APPLICATION**

- A. In raceways, use insulated equipment grounding conductors.
- B. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.
- C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
  - 1. Use insulated spacers; space 1 inch minimum from wall and support 12 inches above finished floor, unless otherwise indicated.
- D. Underground Grounding Conductors: Use bare, tinned, stranded-copper conductors. Bury a minimum of 24 inches below grade or bury 12 inches above duct bank when installed as part of a duct bank.

### **3.2 EQUIPMENT GROUNDING CONDUCTORS**

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Install equipment grounding conductors in all feeders and circuits.
- C. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 4 AWG minimum insulated grounding conductor in raceway from power grounding electrode system to each communications service location, terminal cabinet, wiring closet, and central equipment location.
  - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6.4-by-50-by-300-mm) grounding bus.
  - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- D. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.

### **3.3 INSTALLATION**

- A. Ground Rods:
  - 1. For service entrance, install a minimum of two rods spaced at least twenty-two feet from each other and located at least the same distance from other grounding electrodes.
  - 2. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
  - 3. Interconnect ground rods with grounding electrode conductors. Use exothermic welds for connections to ground rods. Make connections without exposing the ground rod steel.
- B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- C. Building Steel: Provide insulated copper grounding conductor, in conduit, from building's main service equipment, or grounding bus, to building steel. Connect grounding conductors to building steel by bolted compression lug.
- D. Metal Water Service Pipe: Provide insulated copper grounding conductor, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Connection shall be made within the first five feet of where the water service line enters the building. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting.
- E. Where grounding electrode conductors are installed in metal conduit, bond metal conduit to conductor at each end with a grounding bushing.

- F. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, Paragraph 250.52(A)(3), using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG. If using structure concrete foundation, and it is less than 20 feet long, coil excess conductor within the base of the foundation. Bond conductor to reinforcing steel. Extend grounding conductor below grade and connect to building grounding ring or to a grounding electrode external to concrete.

### **3.4 CONNECTIONS**

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
  2. Make connections with clean, bare metal at points of contact.
  3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

### **3.5 FIELD QUALITY CONTROL**

- A. Testing: Perform the following field quality-control testing:
1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
  2. Test completed grounding system at service disconnect enclosure grounding terminal or main ground bar, at ground test wells, and at any other location where a maximum ground-resistance level is specified. Measure ground resistance not less than two full days after the last trace of precipitation, and without the 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.
    - a. Perform tests by the fall-of-potential method according to IEEE 81; or
    - b. Perform tests with a clamp-on ground tester.
  3. Maximum grounding electrode system resistance values:
    - a. Equipment Rated 500 kVA and Less: 10 ohms.
    - b. Equipment Rated 500 to 1000 kVA: 5 ohms.
  4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and take corrective action to reduce ground resistance to comply with specified values. Demonstrate compliance by retesting.

**END OF SECTION**

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**SECTION 26 0533**  
**RACEWAYS AND BOXES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
  - 1. Section "Basic Electrical Materials and Methods" for supports, anchors, and identification products.
  - 2. Section "Wiring Devices" for devices installed in boxes.

**1.3 DEFINITIONS**

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. RNC: Rigid nonmetallic conduit.

**1.4 SUBMITTALS**

- A. Product Data: For raceways, fittings, wireways, floor boxes, hinged-cover enclosures, and cabinets.

**1.5 COORDINATION**

- A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, 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.

**1.6 FIELD CONDITIONS**

- A. Ground Water: Assume ground-water level is at grade level unless a lower water table is noted on Drawings.

**PART 2 - PRODUCTS**

**2.1 METALLIC CONDUIT**

- A. Rigid Aluminum Conduit: Produced to ANSI C80.5; listed to UL 6A.
- B. Rigid Steel Conduit: Produced to ANSI C80.1; listed to UL 6.
- C. IMC: Produced to ANSI C80.6; listed to UL 1242.
- D. EMT and Fittings: Produced to ANSI C80.3; listed to UL 797.
  - 1. Fittings: Plated-steel, hexagonal, compression type.
- E. FMC: Listed to UL 1.
- F. LFMC: Listed to UL 360.
- G. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

**2.2 NONMETALLIC CONDUIT AND TUBING**

- A. RNC: Produced to NEMA TC 2; listed to UL 651.
  - 1. Schedule 40 and Schedule 80 PVC.
- B. RNC Fittings: Produced to NEMA TC 3; listed to UL 514B; match to conduit or tubing type and material.

## **2.3 METAL WIREWAYS**

- A. Listed to UL 870.
- B. Material and Construction: Sheet metal sized and shaped as indicated.
  - 1. Indoors: NEMA 1.
  - 2. Outdoors: NEMA 3R.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Select features as required to complete wiring system and to comply with NFPA 70.
- E. Wireway Covers:
  - 1. Indoors: Hinged type.
  - 2. Outdoors: Flanged-and-gasketed type.
- F. Finish: Manufacturer's standard enamel finish.

## **2.4 BOXES, ENCLOSURES, AND CABINETS**

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.
- C. Floor Box, Metallic Recessed Access and Recessed Floor Box Covers:
  - 1. Floor box with provisions for mounting wiring devices below floor surface.
  - 2. Floor box cover shall have provisions for passage of cords to recessed wiring devices mounted within floor box.
  - 3. Recessed configuration shall accommodate device cords plugged in with plugs being completely concealed with the box cover closed.
- D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- E. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- F. Metal Hinged-Cover Enclosures:
  - 1. Interior Locations: NEMA 250, Type 1 with continuous hinged cover, concealed hinge, and flush latch. Finished inside and out with manufacturer's standard enamel.
  - 2. Exterior Locations: NEMA 250, Type 3R galvanized steel with continuous hinged cover and 3-point latch.
  - 3. Removable interior panel.
  - 4. Metal barriers to separate wiring of different systems and voltages.
  - 5. Accessory feet where required or freestanding applications.
- G. Recessed steel TV box:
  - 1. Power and low voltage applications for flat screen TV's.
  - 2. Recessed space to keep plugs, connectors, and cords inside the box.
  - 3. Non-metallic, paintable white trim plate.
  - 4. Design Basis: Arlington #TVBS Series.
- H. Suspended Ceiling Panels for Projector Mount:
  - 1. 2' x 2', painted white metal.
  - 2. Maximum weight supported: 50 lbs.
  - 3. Independently supported at four corners by wire to building structure. Turnbuckles on each wire for adjustment.
  - 4. 1.5" NPT extension column for projector attachment.
  - 5. Two outlet cutouts.
  - 6. Design Basis: Chief #CMA-455. Equivalents by: Peerless, Strong.

7. Accessory shelf for connection to extension column; height adjustable; 17" x 17" surface minimum, heavy gauge steel, black epoxy finish, 25 lb load capacity.
- I. **HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING**
  1. General Requirements for Handholes and Boxes:
    - a. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
  2. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
    - a. Manufacturers:
      - 1) Armorcast.
      - 2) Oldcastle Infrastructure.
      - 3) Quazite.
      - 4) Preapproved equal.
    - b. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
    - c. Cover:
      - 1) Weatherproof, secured by tamper-resistant locking devices.
      - 2) Structural load rating consistent with enclosure and handhole location. See drawing details for additional requirements.
      - 3) Nonskid finish.
      - 4) Cover legend text as detailed.
    - d. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

### **PART 3 - EXECUTION**

#### **3.1 RACEWAY APPLICATION**

- A. Outdoors:
  1. Exposed: Rigid metal or IMC.
  2. Concealed: Rigid metal or IMC.
  3. Underground, Single Run: RNC.
  4. Underground, Grouped: RNC.
  5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  6. For grounding electrode conductors: RNC Schedule 80.
  7. Boxes and Enclosures: NEMA 250, Type 3R.
- B. Indoors:
  1. Exposed, Higher than 10' AFF: EMT.
  2. Exposed, Lower than 10' AFF:
    - a. In Electrical Rooms: EMT.
    - b. Elsewhere: Rigid metal or IMC.
  3. Concealed:
    - a. Ceilings: EMT.
    - b. Gypboard walls: EMT.
    - c. Masonry walls: RNC.
  4. Underground branch circuits: RNC.
  5. Underground feeders: RNC. Where turning up out of the slab, a rigid metal elbow and rigid metal conduit stub-up shall be used.
  6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.
  7. Damp or Wet Locations: Rigid metal conduit.

- 8. For grounding electrode conductors: RNC Schedule 80.
- 9. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
  - a. Damp or Wet Locations: NEMA 250, Type 4.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
  - 1. Intermediate Steel Conduit: Use threaded rigid metal conduit fittings, unless otherwise indicated.
- E. Do not install aluminum conduits embedded in or in contact with earth or concrete. For direct burial or concrete encasement or penetrations, coat conduit with asphaltum or bituminous type coating.
- F. EMT shall not be installed where raceway or fittings would be in direct contact with the earth, underground, in/below concrete, exposed to the elements, exposed to severe physical damage, or exposed to severe corrosive influence.

### **3.2 INSTALLATION**

- A. Keep raceways a minimum of 6 inches away from runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- B. Complete raceway installation before starting conductor installation.
- C. Support raceways as specified in Section "Basic Electrical Materials and Methods."
- D. Install temporary closures to prevent foreign matter from entering raceways.
- E. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.
- F. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.
- G. Conceal raceways within finished walls, ceilings, and floors, unless otherwise indicated.
  - 1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.
- H. Conduits installed on the inside face of exterior building walls shall be spaced off the wall surface a minimum of 1/4" using strut-type channel or "clamp-backs".
- I. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
  - 1. Run parallel or banked raceways together on common supports.
  - 2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- J. Join raceways with fittings designed and approved for that purpose and make joints tight.
- K. Raceway connectors shall be insulated throat type. If uninsulated throat connectors are installed, use insulating bushings to protect conductors.
- L. Expansion Fittings:
  - 1. Where raceways of any type pass a building or structure expansion joint, a standard expansion fitting shall be provided and installed. Review architectural and structural drawings for locations of expansion joints.
  - 2. Where raceways installed are subject to temperature swings, install expansion fittings spaced in accordance with manufacturer instructions and NFPA 70 requirements.
  - 3. Expansion fittings shall be compatible with the type of raceway being used.
- M. Underground raceways:
  - 1. Where turning up to cabinets, equipment, poles, etc.; transition from horizontal underground PVC to rigid metal for elbows & raceway stub-ups, unless detailed otherwise.

- N. Terminations:
1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
  2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
  3. Where using boxes with concentric, eccentric, or over-sized knockouts; provide bonding bushings and jumpers. Size bonding jumpers in accordance with NEC Table 250-122, connecting to the box with ground lugs.
- O. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Label each end of pull wires with location of opposite end.
- P. Telephone and Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
- Q. Flexible Connections:
1. Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures.
  2. Use maximum of 24 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for all motors.
  3. Use LFMC in damp or wet locations.
- R. Install hinged-cover enclosures and cabinets plumb. Support at each corner.
- S. Set floor boxes level and flush with finished floor surface.

### **3.3 PROTECTION**

- A. Provide final protection and maintain conditions that ensure coatings and finishes are without damage or deterioration at time of Final Acceptance.
1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

### **3.4 CLEANING**

- A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.
1. Exposed threads on galvanized conduits and fittings, installed outdoors, shall be coated with galvanizing paint or equivalent protective coating.

**END OF SECTION**

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**SECTION 26 0553**  
**ELECTRICAL IDENTIFICATION**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes electrical identification materials and devices intended to comply with NFPA 70, OSHA standards, and authorities having jurisdiction.

**1.3 SUBMITTALS**

- A. Product Data:
  - 1. For each electrical identification product indicated.
  - 2. For double coated, adhesive tape product indicated.

**1.4 QUALITY ASSURANCE**

- A. Comply with NFPA 70 for color-coding.

**PART 2 - PRODUCTS**

**2.1 CABLE LABELS**

- A. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches.
- B. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape.
  - 1. Not less than 6 inches wide by 4 mils thick.
  - 2. Compounded for permanent direct-burial service.
  - 3. Embedded continuous metallic strip or core.
  - 4. Printed legend indicating type of underground line.

**2.2 NAMEPLATES AND SIGNS**

- A. Engraved Plastic Nameplates and Signs: Engraving stock, plastic laminate, minimum 1/16" thick for signs up to 20 sq. in. and 1/8" thick for larger sizes.
- B. Fasteners for Nameplates and Signs:
  - 1. Two-part epoxy adhesive.
  - 2. High performance, double coated tape with adhesive. Design Basis: 3M #06383, or approved equivalent.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Identification Materials and Devices: Install locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.
- C. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before applying.
- E. Circuit Identification Labels on Boxes: Panel and circuit number.
  - 1. Interior Boxes:
    - a. Exposed: Pressure-sensitive, self-adhesive plastic label on cover.
    - b. Concealed:
      - 1) Pressure-sensitive, self-adhesive plastic label on cover; or

- 2) Permanent marker on cover, legible in a standing position by Design Team and Owner.
2. Exterior Boxes:
  - a. Engraved plastic label on cover; and
  - b. Pressure-sensitive, self-adhesive plastic label inside cover.
- F. Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communication lines; install continuous underground-line warning tape located directly above line at 6 to 8 inches below finished grade. Where width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches overall, use a single line marker. Install line marker for underground wiring, both direct-buried cables and cables in raceway.
- G. Color-Coding of Phase, Neutral, and Ground Conductors: Use the following colors for service, feeder, and branch-circuit phase conductors:
  1.
 

Configuration	Phase A	Phase B	Phase C	Neutral	Ground
120/240-V, 1 Ph, 3W	Black	Red	N/A	White	Green
120/240-V, 3 Ph, 4W	Black	Orange	Blue	White	Green
120/208-V, 3 Ph, 4W	Black	Red	Blue	White	Green
277/480-V, 3 Ph, 4W	Brown	Orange	Yellow	Gray	Green
  2. For conductors #6 AWG and smaller, factory apply color the entire length of conductors.
  3. For conductors #4 AWG and larger, field apply colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.
  4. At each panelboard, a color code legend shall be permanently posted corresponding to the conductors and voltage in that panelboard.
- H. Apply identification to conductors as follows:
  1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.
  2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.
  3. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.
- I. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment. Attach engraved labels with two-part epoxy adhesive or high performance double coated adhesive tape. Apply labels for each unit of the following categories of equipment:
  1. Switchgear, switchboards, panelboards, electrical cabinets, and enclosures.
  2. Access doors and panels for concealed electrical items.
  3. Disconnect switches and enclosed circuit breakers.
  4. Inverters.
  5. Contactors.
  6. Emergency system boxes and enclosures.
  7. Transfer switches.
  8. Fire alarm control panels, master stations, control panels, local operator consoles, and power supplies.
  9. Emergency responder radio coverage system.
  10. Security-monitoring master stations and control panels.
  11. Telephone system equipment.
  12. TV / audio / video system equipment.

Nameplate colors shall be: White surface with black core.

#### END OF SECTION

**SECTION 26 0923**  
**LIGHTING CONTROL DEVICES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes the following lighting control devices:
  - 1. Time switches.
  - 2. Outdoor photoelectric switches
  - 3. Switchbox-mounted occupancy and vacancy sensors.
  - 4. Indoor occupancy and vacancy sensors.
  - 5. Multipole lighting contactors.

**1.3 DEFINITIONS**

- A. PIR: Passive infrared.

**1.4 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
  - 1. Plan indicating typical coverage area of each sensor.
  - 2. Interconnection diagrams showing field-installed wiring.
- C. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

**1.5 COORDINATION**

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

**2.2 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS**

- A. Line-Voltage Surge Protection: An integral part of the devices for 120- and 277-V solid-state equipment. For devices without integral line-voltage surge protection, field-mounting surge protection shall comply with IEEE C62.41 and with UL 1449.

**2.3 TIME SWITCHES**

- A. Manufacturers:
  - 1. Area Lighting Research, Inc.
  - 2. Fisher Pierce.
  - 3. Grasslin Controls Corporation.
  - 4. Intermatic, Inc.
  - 5. Paragon Electric Co.
  - 6. Sensor Worx.
  - 7. TORK.
  - 8. Watt Stopper (The).

- B. Digital Time Switches: Electronic, solid-state programmable units with alphanumeric display complying with UL 917.
  - 1. Contact Configuration: DPST.
  - 2. Contact Rating: 30-A inductive or resistive, 240-V ac.
  - 3. Program: Two channel minimum, 8 on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.
  - 4. Circuitry: Allow connection of a photoelectric relay as substitute for on and off function of a program.
  - 5. Astronomical Time: All channels.
  - 6. Battery Backup: For schedules and time clock.

## **2.4 OUTDOOR PHOTOELECTRIC SWITCHES**

- A. Manufacturers:
  - 1. Area Lighting Research, Inc.
  - 2. Fisher Pierce.
  - 3. Grasslin Controls Corporation.
  - 4. Intermatic, Inc.
  - 5. Paragon Electric Co.
  - 6. TORK.
  - 7. Touchplate Technologies, Inc.
  - 8. Watt Stopper (The).
- B. Description: Solid state, with DPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, microprocessor input, and complying with UL 773A.
  - 1. Light-Level Monitoring Range: 1.5 to 10 fc (16 to 108 lx), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
  - 2. Time Delay: 15-second minimum, to prevent false operation.
  - 3. Surge Protection: Metal-oxide varistor type, complying with IEEE C62.41 for Category A1 locations.
  - 4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the North sky exposure.

## **2.5 SWITCHBOX-MOUNTED OCCUPANCY AND VACANCY SENSORS**

- A. Manufacturers:
  - 1. Cooper Controls.
  - 2. Hubbell Lighting Inc.
  - 3. Leviton Mfg. Company Inc.
  - 4. Watt Stopper (The).
- B. Description: Dual technology, ultrasonic and PIR type, with integral power-switching contacts rated for 800 W at 120-V ac and 1200 W at 277-V ac, minimum; suitable for electronic ballasts, LED drivers, or 1/6-hp motors.
  - 1. Field configurable occupancy sensing or vacancy sensing operating modes. Operation:
    - a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
    - b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
  - 2. Include ground wire.
- C. Single Relay Unit: Device contains one relay for controlling load circuit.
  - 1. Design Basis: Hubbell # LHMTS1.

2. One On-Off button for manual control.
- D. Dual Relay Unit: Device contains two relays for controlling independent lighting loads or circuits.
  1. Design Basis: Hubbell #LHMTD2.
  2. Two On-Off buttons for manual control.
- E. Dimmer Unit:
  1. Design Basis: Legrand / WattStopper #DW-311.
  2. Dimming Control Signal: 0-10 VDC.
  3. Suitable for multi-way control from up to four locations.

## 2.6 INDOOR OCCUPANCY AND VACANCY SENSORS

- A. Manufacturers:
  1. Cooper Controls.
  2. Hubbell Lighting Inc.
  3. Leviton Mfg. Company Inc.
  4. Watt Stopper (The).
- B. General Description: Wall- or ceiling-mounting, as indicated on the drawings; low-voltage solid-state units with separate line-voltage relay units.
  1. Configurable occupancy sensing or vacancy sensing operating modes. Operation:
    - a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
    - b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
  2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
  3. Relay Units: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
    - a. Where indicated for 277-V ac lighting systems, provide additional relay units where required for simultaneous control of 120-V ac exhaust fans.
  4. Mounting:
    - a. Sensor: Suitable for mounting in any position on a standard outlet box.
    - b. Relay: Externally mounted though a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
    - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
  5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
  6. Bypass Switch: Override the on function in case of sensor failure.
- C. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on and off functions shall be selectable in the field by operating controls on unit.
  1. Sensitivity Adjustment: Separate for each sensing technology.
  2. Detector Sensitivity: Detect occurrences of 6-inch minimum movement of any portion of a human body that presents a target of at least 36 sq. in., and detect a person of average size and weight moving at least 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/second.
  3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch-high ceiling.

- D. Design Basis: Hubbell # OMNIDT2000. If room size is significantly smaller than 2000 sq. ft., evaluate the use of a unit with applicably sized reduced range.

## **2.7 MULTIPOLE LIGHTING CONTACTORS**

- A. Manufacturers:
  - 1. Allen-Bradley/Rockwell Automation.
  - 2. Cutler-Hammer; Eaton Corporation.
  - 3. GE Industrial Systems.
  - 4. Siemens.
  - 5. Square D.
- B. Description: Electrically operated and mechanically held, complying with NEMA ICS 2 and UL 508. Contactors shall be provided as packaged assembly in factory enclosure.
  - 1. Current Rating for Switching: 30A, unless noted otherwise.
  - 2. Control-Coil Voltage: Match control power source.

## **PART 3 - EXECUTION**

### **3.1 SENSOR INSTALLATION**

- A. Install and aim sensors in locations to achieve at least 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

### **3.2 WIRING INSTALLATION**

- A. Wiring Method: Comply with Section "Conductors and Cables".
- B. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

### **3.3 IDENTIFICATION**

- A. Identify components and power and control wiring according to Section "Electrical Identification".
- B. Label time switches and contactors with a unique designation.

### **3.4 FIELD QUALITY CONTROL**

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
  - 2. Operational Test: Verify actuation of each sensor and adjust time delays.
- B. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements and control intent.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### **3.5 ADJUSTING**

- A. Occupancy Adjustments: When requested within 6 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
  - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.

**END OF SECTION**

**SECTION 26 2416**  
**PANELBOARDS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Distribution panelboards.
  - 2. Lighting and appliance branch-circuit panelboards.

**1.3 DEFINITIONS**

- A. GFCI: Ground-fault circuit interrupter.
- B. GFEP: Ground-fault equipment protection.
- C. RMS: Root mean square.

**1.4 SUBMITTALS**

- A. Product Data: For each type of panelboard, overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Enclosure types and details for types other than NEMA 250, Type 1.
    - b. Trim types and details.
    - c. Bus configuration, current, and voltage ratings.
    - d. Short-circuit current rating of panelboards and overcurrent protective devices.
    - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- C. Panelboard Directories: For installation in panelboards.
- D. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals.

**1.5 QUALITY ASSURANCE**

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.
- B. Comply with NEMA PB 1.

**1.6 COORDINATION**

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

**1.7 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. Keys: Six spares for each type of panelboard cabinet lock.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Panelboards, Overcurrent Protective Devices, and Accessories:
    - a. ABB / G.E.
    - b. Eaton Corporation; Cutler-Hammer Products.
    - c. Siemens Energy & Automation, Inc.
    - d. Square D.

### **2.2 MANUFACTURED UNITS**

- A. Enclosures: Flush- and surface-mounted cabinets, as scheduled in the drawings.
  - 1. Rated for environmental conditions at installed location.
    - a. Typical Indoor Locations: NEMA 250, Type 1.
      - 1) Front Hinged Cover: Entire front trim hinged to box with full-length piano hinge, and with standard door within hinged trim cover.
      - 2) Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
    - b. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
      - 1) Front Hinged Cover: Entire front trim hinged to box with full-length piano hinge, and with standard door within hinged trim cover.
    - c. Outdoor Locations: NEMA 250, Type 3R.
    - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
  - 2. Front Cover: Doors with concealed hinges; secured with flush latch with tumbler lock; keyed alike.
  - 3. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.
- B. Phase Buses:
  - 1. Material: Hard-drawn copper, 98 percent conductivity.
- C. Ground and Neutral Bars:
  - 1. Equipment Ground Bar: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
  - 2. Neutral Bar: Neutral bar shall be fully sized to match the panel ampere rating. Neutral bar terminal quantity shall be sized adequately for the quantity of feeder and branch-circuit neutral conductors.
- D. Conductor Connectors: Suitable for use with conductor material.
  - 1. Main and Neutral Lugs: Mechanical type.
  - 2. Ground Lugs and Bus Configured Terminators: Mechanical or compression type.
- E. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
- F. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices. These locations will be indicated as SPACE on the panel schedules in the drawings.

### **2.3 PANELBOARD SHORT-CIRCUIT RATING**

- A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

### **2.4 OVERCURRENT PROTECTIVE DEVICES**

- A. Main Overcurrent Protective Devices: Circuit breaker, where scheduled.
- B. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

- C. Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.
  - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  - 2. GFCI Circuit Breakers: 5-mA trip sensitivity for personnel protection; single- and two-pole configurations.
  - 3. GFEP Circuit Breakers: 30-mA trip sensitivity for equipment protection; single- and two-pole configurations.
  - 4. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- D. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
  - 1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
  - 2. Multipole units enclosed in a single housing or factory-assembled to operate as a single unit.
  - 3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
  - 4. Shunt Trip: Where required or indicated, 120-V trip coil energized from separate circuit.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Mount top of trim 74 inches above finished floor, unless otherwise indicated.
- C. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- D. Install overcurrent protective devices and controllers. Set field-adjustable circuit-breaker trip ranges. Prepare documentation of circuit breaker trip settings for Owner record documents.
- E. Panel breaker configurations shall be installed as indicated on the panel schedules or as noted. Breaker position revisions will not be accepted unless approved in writing by the Engineer.
- F. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- G. Install filler plates in unused spaces.

#### **3.2 IDENTIFICATION**

- A. Create a directory to indicate installed circuit loads. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- B. Panelboard Nameplates: Label each panelboard with laminated-plastic nameplate mounted as specified in Section "Electrical Identification".

#### **3.3 CONNECTIONS**

- A. Ground equipment according to Section "Grounding and Bonding".
- B. Connect wiring according to Section "Conductors and Cables".

#### **3.4 FIELD QUALITY CONTROL**

- A. Prepare for acceptance tests as follows:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
  - 3. Neutral-ground bond testing: 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 megger reading between the neutral bar and grounded enclosure. If this reading is less than 25 mega-ohms, the CONTRACTOR

shall disconnect the branch circuit neutral wires from the neutral bar. The CONTRACTOR shall then test each one separately to the panel until the low reading ones are found. The CONTRACTOR shall correct troubles, re connect, and re test until at least 25 mega-ohms from the neutral bar to the grounded panel can be achieved with only the neutral feeder disconnected.

- B. Perform the following field tests and inspections and prepare test reports:
  - 1. Perform each electrical test and visual and mechanical inspection stated in manufacturer's installation instructions for molded-case circuit breakers.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

### **3.5 CLEANING**

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

**END OF SECTION**

**SECTION 26 2726**  
**WIRING DEVICES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Single and duplex receptacles and ground-fault circuit interrupter receptacles.
  - 2. Single- and double-pole snap switches and dimmer switches.
  - 3. Device wall plates.
  - 4. Floor service outlets.

**1.3 DEFINITIONS**

- A. GFCI: Ground-fault circuit interrupter.

**1.4 SUBMITTALS**

- A. Product Data: For each type of product indicated.

**1.5 QUALITY ASSURANCE**

- A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Wiring Devices:
    - a. Bryant Electric, Inc./Hubbell Subsidiary.
    - b. Eagle Electric Manufacturing Co., Inc.
    - c. Hubbell Incorporated; Wiring Device-Kellems.
    - d. Leviton Mfg. Company Inc.
    - e. Lutron.
    - f. Pass & Seymour/Legrand; Wiring Devices Div.
  - 2. Floor Service Outlets:
    - a. Hubbell Incorporated; Wiring Device-Kellems.
    - b. Pass & Seymour/Legrand; Wiring Devices Div.
    - c. Square D/Groupe Schneider NA.
    - d. Thomas & Betts Corporation.
    - e. Wiremold Company (The).

**2.2 RECEPTACLES**

- A. Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596, and UL 498.
- B. Straight-Blade and Locking Receptacles:
  - 1. Heavy-Duty grade.
  - 2. Arranged for back and side wiring with brass screws.
  - 3. Grounding type with hex head ground screw terminal.
  - 4. 15-amp and 20-amp, 125-Volt and 250-Volt receptacles in damp or wet locations shall be listed weather-resistant type.
  - 5. Receptacles shall accommodate back and side wiring and shall be grounding type with separate single or double grounding screw terminals.

- C. Tamper-Resistant Convenience Receptacles, 125 V, 15 & 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.
- D. GFCI Receptacles:
  - 1. Straight blade, feed-through type, Heavy-Duty grade, with integral NEMA WD 6, Configuration 5-20R duplex receptacle.
  - 2. Comply with UL 498 and UL 943.
  - 3. Design units for installation in a 2-3/4-inch-deep outlet box without an adapter.

## **2.3 SWITCHES**

- A. Toggle Switches: Comply with UL 20.
  - 1. Heavy-Duty grade, , quiet type without the use of mercury switches.
  - 2. Arranged for back and side wiring with brass screws.
  - 3. Grounding type with hex head ground screw terminal.
  - 4. Types:
    - a. Single-pole.
    - b. Two-pole.
    - c. Three-way.
    - d. Four-way.
- B. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible frequency and EMI/RFI filters.
  - 1. Control: Continuously adjustable slider; with single-pole or three-way switching to suit connections.

## **2.4 WALL PLATES**

- A. Single and combination types to match corresponding wiring devices.
  - 1. Size: All plates shall be oversized / jumbo with matching vertical dimension.
  - 2. Plate-Securing Screws: Metal with head color to match plate finish.
  - 3. Material for Finished Spaces: 0.035-inch- (1-mm-) thick, satin-finished stainless steel.
  - 4. Material for Unfinished Spaces: Galvanized steel.
  - 5. Material for Wet Locations: Cast aluminum, weatherproof, "in-use" type. Receptacle box covers shall be weatherproof whether or not a cord & plug are inserted or not.
  - 6. Toggle Switch Serving as a Disconnect: Wallplate shall be configured with brackets on both sides of the switch to accommodate a padlock to secure the switch in the Off position.

## **2.5 FLOOR SERVICE FITTINGS**

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Rectangular, die-cast aluminum with satin finish.
- D. Power Receptacle: NEMA WD 6, Configuration 5-20R, unless otherwise indicated.
- E. Voice and Data Communication Outlet: Modular, keyed, color-coded, RJ-45 jacks for data cable, unless otherwise indicated.

## **2.6 FINISHES**

- A. Color:
  - 1. Wiring Devices Connected to Normal Power System: White, unless otherwise indicated or required by NFPA 70.

# **PART 3 - EXECUTION**

## **3.1 INSTALLATION**

- A. Install devices and assemblies level, plumb, and square with building lines.
  - 1. Installation height shall be as detailed in the drawings.

- B. Install tamper-resistant receptacles at locations as required by the NEC and/or the local authority having jurisdiction.
- C. Install unshared neutral conductors online and load side of dimmers according to manufacturers' written instructions.
- D. Arrangement of Devices: Mount flush unless noted otherwise:
  - 1. Receptacles over counters, backsplashes, etc. shall be mounted with long dimension horizontal.
  - 2. Otherwise, unless noted differently, mount with long dimension vertical, and with grounding terminal of receptacles on top.
  - 3. Group adjacent switches under single, multigang wall plates.
- E. Remove wall plates and protect devices and assemblies during painting.
- F. Adjust locations of floor service outlets to suit arrangement of partitions and furnishings. Coordinate final placement with Architect and Owner.

### **3.2 IDENTIFICATION**

- A. Comply with Section "Electrical Identification."
  - 1. Receptacles and Switches: Identify panelboard and circuit number from which served. Use hot, stamped / thermal printing with black-filled lettering on face of plate, and durable wire markers inside outlet boxes.

### **3.3 CONNECTIONS**

- A. Ground equipment according to Section "Grounding and Bonding".
- B. Connect wiring according to Section "Conductors and Cables".

### **3.4 FIELD QUALITY CONTROL**

- A. Perform the following field tests and inspections:
  - 1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
  - 2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- B. Remove malfunctioning units, replace with new units, and retest as specified above.

**END OF SECTION**

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**SECTION 26 2816**  
**ENCLOSED SWITCHES AND CIRCUIT BREAKERS**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Fusible switches.
  - 2. Molded-case circuit breakers (MCCBs).
  - 3. Enclosures.

**1.2 ACTION SUBMITTALS**

- A. Product Data:
  - 1. For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
  - 2. Enclosure types and details for types other than UL 50E, Type 1.
  - 3. Current and voltage ratings.
  - 4. Short-circuit current ratings (interrupting and withstand, as appropriate).
  - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
- B. Shop Drawings: For enclosed switches and circuit breakers.
  - 1. Include plans, elevations, sections, details, and attachments to other work.

**1.3 CLOSEOUT SUBMITTALS**

- A. Warranty documentation.
- B. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. If Section "Operation and Maintenance Data" is included in the project manual, in addition to items there, include the following:
  - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
  - 2. Time-current curves, including selectable ranges for each type of circuit breaker.
  - 3. Circuit breaker trip settings.

**1.4 WARRANTY**

- A. Special Installer Extended Warranty: Installer warrants that fabricated and installed enclosed switches and circuit breakers perform in accordance with specified requirements and agrees to repair or replace components or products that fail to perform as specified within warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion; full coverage for labor, materials, and equipment.

**PART 2 - PRODUCTS**

**2.1 GENERAL REQUIREMENTS**

- A. Source Limitations: Obtain products from single manufacturer.
- B. Manufacturers:
  - 1. ABB / G.E.
  - 2. Eaton Corporation; Cutler-Hammer Products.
  - 3. ESL Power Systems.
  - 4. Hubbell.
  - 5. Legrand.
  - 6. Siemens Energy & Automation, Inc.
  - 7. Square D/Group Schneider.

- C. Product Selection for Restricted Space: Where drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

## **2.2 FUSIBLE SWITCHES**

- A. Type HD, Heavy Duty:
  - 1. Single throw.
  - 2. Pole quantity, voltage, and Amperage as required for circuit controlled.
  - 3. UL 98 and NEMA KS 1, horsepower rated. Where fused, clips or bolt pads shall accommodate fuses rated for the nameplate rating of equipment controlled.
  - 4. Lockable handle with provisions to lock in either the On or OFF position and interlocked with cover in closed position.
- B. Accessories:
  - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  - 3. Service-Rated Switches: Labeled for use as service equipment.
  - 4. Lugs: Suitable for number, size, and conductor material as indicated in the drawings.

## **2.3 MOLDED-CASE CIRCUIT BREAKERS**

- A. Standard: Comply with UL 489 with required interrupting capacity for available fault currents.
- B. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

## **2.4 ENCLOSURES**

- A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, UL 50E, and UL 50, to comply with environmental conditions at installed location.
- B. Enclosure Finish:
  - 1. Indoor Locations: UL 50E Type 1.
  - 2. Outdoor Locations: UL 50E Type 3R.

# **PART 3 - EXECUTION**

## **3.1 EXAMINATION**

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of work will indicate Installer's acceptance of areas and conditions as satisfactory.

## **3.2 INSTALLATION**

- A. Comply with manufacturer's published instructions.
- B. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- C. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
  - 1. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

2. Install fuses in fusible devices.

### **3.3 IDENTIFICATION**

- A. Comply with requirements in Section 260553 "Electrical Identification."
  1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  2. Label each enclosure with engraved-plastic nameplate.

### **3.4 FIELD QUALITY CONTROL**

- A. Tests and Inspections:
  1. Visual and Mechanical Inspection:
    - a. Verify that equipment nameplate data are as described in the Specifications and shown on Drawings.
    - b. Inspect physical and mechanical condition.
    - c. Inspect anchorage, alignment, grounding, and clearances.
    - d. Verify that unit is clean. Clean interior with vacuum, not compressed air.
    - e. Inspect exposed surfaces and repair damaged finishes.
    - f. Inspect bolted electrical connections for high resistance. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of lowest value.
    - g. Switches:
      - 1) Verify blade alignment, blade penetration, travel stops, and mechanical operation.
      - 2) Verify that fuse sizes and types match the Specifications, Drawings, and equipment nameplate rating requirements.
      - 3) Verify that each fuse has adequate mechanical support and contact integrity.
    - h. Circuit Breakers:
      - 1) Operate circuit breaker to ensure smooth operation.
      - 2) Inspect operating mechanism, contacts, and chutes in unsealed units.
  2. Electrical Tests:
    - a. Perform resistance measurements through bolted connections with low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of lowest value.
    - b. Circuit Breakers:
      - 1) Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of shunt trip and close coils must be as indicated by manufacturer.
- B. Nonconforming Work:
  1. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
  2. Remove and replace defective units and retest.

### **3.5 ADJUSTING**

- A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.

### **3.6 PROTECTION**

- A. After installation, protect enclosed switches and circuit breakers from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

**END OF SECTION**

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**SECTION 26 3213**  
**ENGINE GENERATORS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section includes packaged engine-generator sets for optional standby power supply. Include the following features:
  - 1. Diesel engine.
  - 2. Unit-mounted cooling system.
  - 3. Unit-mounted control and monitoring.
  - 4. Performance requirements for sensitive loads.
  - 5. Fuel system.
  - 6. Outdoor enclosure.
- B. Related Requirements:
  - 1. Section "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

**1.3 DEFINITIONS**

- A. AHJ: Authority Having Jurisdiction.
- B. ECM: Engine Control Module.
- C. Optional Standby Power Supply: NEC 702, Optional Standby Systems.
- D. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

**1.4 SUBMITTALS**

- A. PDF files of submittal data shall be provided.

**1.5 ACTION SUBMITTALS**

- A. Product Data: For each type of product, standard accessories, and optional accessories.
  - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
  - 2. Include motor starting performance curve(s) indicating voltage drop for motor starting conditions.
  - 3. Include thermal damage curve for generator.
  - 4. Include time-current characteristic curves for generator protective devices.
  - 5. Include fuel consumption in gallons per hour at 0.8 power factor at 0.5, 0.75 and 1.0 times generator capacity.
  - 6. Include generator efficiency at 0.8 power factor at 0.5, 0.75 and 1.0 times generator capacity.
  - 7. Include generator characteristics, including, but not limited to kw rating, efficiency, reactances, and short-circuit current capability.
- B. Shop Drawings:
  - 1. Include plans and elevations for engine-generator set, subbase fuel tank, enclosure, and other components specified and/or provided. Indicate recommended equipment pad dimensions. Indicate access requirements affected by height of subbase fuel tank.
  - 2. Include details of equipment assemblies. Indicate dimensions, weights, center of gravity of full assembly, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Identify fluid drain ports and clearance requirements for proper fluid drain.
4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include base weights.
5. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for EPS equipment, automatic transfer switch, and functional relationship between all electrical components.

#### **1.6 INFORMATIONAL SUBMITTALS**

- A. Specification Compliance Markup: Submit a mark-up copy of this specification with notations and explanations comprehensively showing all deviations and / or exceptions to these Specifications.
- B. Qualification Data: For supplier / installer.
  1. Statement from supplier / installer detailing local service capability, factory-trained service personnel, and details of service response required in accordance with this specification. Reference section 1.9A.31.9A.3 for service response guarantee.
- C. Source quality-control reports, including, but not limited to the following:
  1. Report of exhaust emissions showing compliance with applicable regulations.
- D. Field quality-control reports.
- E. Warranty: For special warranty.

#### **1.7 CLOSEOUT SUBMITTALS**

- A. Initial Manual Submittal for Review: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Owner and/or Engineer will comment on whether scope and content of manual are acceptable.
  1. Correct or revise each manual to comply with Owner and/or Engineer comments. Submit copies of each corrected manual as the Final Manual Submittal.
- B. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training.
  1. Format: Submit operations and maintenance manuals in the following formats.
    - a. PDF electronic file. Submit electronic file via email and USB drive.
    - b. Two paper copies in heavy-duty, three-ring, loose-leaf binders. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.
- C. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. Data shall be provided and identified that is specific to the site where equipment is installed.
  1. 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.
  2. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
    - a. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents.
    - b. Product information.
    - c. Maintenance procedures.
    - d. Maintenance and service schedules.
    - e. 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.
    - f. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
    - g. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

- h. Warranties: Include copies of warranties and lists of circumstances and conditions that would affect validity of warranties. Include procedures to follow and required notifications for warranty claims.
- 3. Operation Manuals: Assemble a complete set of operation data indicating operation of each system, subsystem, and piece of equipment not part of a system.
  - a. System, subsystem, and equipment descriptions.
  - b. Operating procedures.
  - c. Wiring diagrams.
  - d. Control diagrams.
  - e. Piped system diagrams.
- 4. 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.
- 5. Additionally, include the following:
  - a. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
  - b. Operating instructions laminated and mounted adjacent to generator location.
  - c. Training plan.
  - d. Software for unit controller with diagnostic, troubleshooting, and maintenance functionality.

## **1.8 EXTRA MATERIALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: One for every 10 of each type and rating but no fewer than one of each.
  - 2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
  - 3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.
  - 4. Paint: Two spray cans of each color.
  - 5. Keys: Four keys for enclosure access doors.
  - 6. Special Tools: Tools unique to the product for standard maintenance, listed by part number in operations and maintenance manual.

## **1.9 QUALITY ASSURANCE**

- A. Supplier / Installer Qualifications:
  - 1. Manufacturer and factory authorized representative who is trained and approved by manufacturer.
  - 2. Maintain, within 125 miles or two hours of Hampstead, North Carolina; a factory certified service center capable of providing training, parts, and emergency maintenance repairs.
  - 3. Response for emergency repairs shall be guaranteed to be four hours or less upon receipt of service call notification.
  - 4. Manufacturer's authorized representative shall employ factory-trained and certified service personnel and shall carry single-source responsibility for warranty, parts, and service.

## **1.10 WARRANTY**

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period at no additional cost to the Owner.
  - 1. Warranty Period: 2 years or 2500 hours, whichever occurs first, from date of start-up and Substantial Completion.

### **1.11 SERVICE CONTRACT**

- A. Manufacturer's service representative shall provide a service contract at no additional cost to the Owner for a period of 2 years from date of start-up and Substantial Completion of the generator set installation.
- B. At the Owner's option, the service agreement shall be renewable on a year-to-year basis, thereafter, with costs being paid by the Owner.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Caterpillar.
  - 2. Generac.
  - 3. MTU.
- B. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer. Generator set shall be standard offering from manufacturer.

### **2.2 PERFORMANCE REQUIREMENTS**

- A. NFPA Compliance:
  - 1. Comply with NFPA 30.
  - 2. Comply with NFPA 37.
  - 3. Comply with NFPA 70.
  - 4. Comply with NFPA 110 requirements for Level 1 emergency power supply system.
- B. UL Compliance: Comply with UL 2200/CSA.
- C. Engine Exhaust Emissions: Comply with EPA Tier 3 requirements and applicable state and local government requirements.
- D. Noise Emission:
  - 1. At a minimum, sound level measured at a distance of 23 feet from the unit after installation is complete shall be 75 dBA or less.
  - 2. Verify with the Owner and/or Engineer if more restrictive noise emission is required due to a generator unit being located near a property line.
  - 3. Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.
- E. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
  - 1. Ambient Temperature: Minus 15 to plus 50 deg C.
  - 2. Altitude: Sea level to 100 feet.

### **2.3 ASSEMBLY DESCRIPTION**

- A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.
- B. EPSS Class: Engine-generator set shall be classified as a Class 72 in accordance with NFPA 110.
- C. Governor: Adjustable isochronous, with speed sensing.
- D. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.
  - 1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

- E. Capacities and Characteristics:
  - 1. Power Output Ratings: Nominal ratings as indicated on the drawings at 0.8 power factor excluding power required for the continued and repeated operation of the unit and auxiliaries.
  - 2. Output Connections: As indicated on the drawings.
  - 3. Voltage: As indicated on the drawings.
  - 4. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component. Nameplate shall be in accordance with NFPA70.
- F. Generator-Set Performance:
  - 1. Oversizing alternator compared with the rated power output of the engine is permissible to meet specified performance.
    - a. Nameplate Data for Oversized Generator: Show ratings required by the Contract Documents rather than ratings that would normally be applied to generator size installed.
  - 2. Steady-State Voltage Operational Bandwidth: 2 percent of rated output voltage from no load to full load.
  - 3. Transient Voltage Performance:
    - a. Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 3 seconds.
    - b. Not more than 25 percent dip under worst case motor starting conditions. See Informational Submittals, Voltage Drop Calculations for specific step loading criteria.
  - 4. Steady-State Frequency Operational Bandwidth: Plus or minus 0.25 percent of rated frequency from no load to full load.
  - 5. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
  - 6. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within 5 seconds.
  - 7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to winding insulation or other generator system components.
  - 8. Block Load Performance: per NFPA110, the unit shall be able to fully recover from a 100% block load.
  - 9. Excitation System: Performance shall be unaffected by 10% total voltage distortion (THD) caused by nonlinear load.
    - a. Provide permanent magnet excitation (PMG) for power source to voltage regulator.
  - 10. Start Time: Comply with NFPA 110, Type 10, system requirements.

## **2.4 ENGINE**

- A. Fuel: Diesel Fuel oil, Grade DF-2.
- B. Engine Rating: Prime mover shall have adequate horsepower to meet the specified kW at the specified site altitude and temperatures. Products that de-rate below specified kW for temperature or altitude shall not be accepted.
- C. Rated Engine Speed: 1800 rpm.
- D. Cylinders: For units 300 kW and larger, cylinders shall be cast iron, sleeved.
- E. Lubrication System: The following items shall be mounted on engine or skid:
  - 1. Positive displacement, full pressure lubrication oil pump.
  - 2. Filter and Strainer: Per manufacturer recommendations.

3. Dipstick to check oil level.
  4. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
- F. Jacket Coolant Heater:
1. Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity. Heater(s) shall be 3<sup>rd</sup> party listed.
  2. 1500-watts, 120 volt minimum. Provide higher capacity heater as required based on manufacturer requirements for engine size.
  3. Thermostatically controlled to maintain engine coolant at not less than 90 deg F in 32 deg F ambient.
  4. Shut-off valve to simplify replacement of the heater.
- G. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.
1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
  2. Cooling System Sizing: Sized to adequately cool the generator set, including aftercooler, without de-rate to an ambient temperature of 122 deg F (50 deg C) for diesel. Maximum external restriction shall be no greater than 0.5 inch of water column.
  3. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
  4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
  5. Blower fan, water pump, thermostat, and radiator duct flange shall properly cool the engines in 105 deg F ambient with up to 0.5 inches H<sub>2</sub>O static pressure on the fan. Radiator shall include a duct flange adapter for connection to the discharge air vent.
  6. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
    - a. Rating: 50-psig maximum working pressure with coolant at 180 deg F (82 deg C), and non-collapsible under vacuum.
    - b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
- H. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.
- I. Starting System: 12 or 24-V electric, with negative ground.
1. Components: Sized so they are not damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Performance Requirements" Article.
  2. Cranking / Starting Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
    - a. Speed sensing and a second independent starter motor disengagement systems shall protect against starter engagement with a moving flywheel.
  3. Cranking Cycle: As required by NFPA 110 for system level specified.
    - a. Cranking cycle with 15 second ON and OFF cranking periods.
    - b. Over-crank protection designed to open the cranking circuit after 75 seconds if the engine fails to start.
    - c. The starting system shall be designed for restarting in the event of a false engine start, by permitting the engine to completely stop and then re-engage the starter.
  4. The starting system shall be designed for restarting in the event of a false engine start, by permitting the engine to completely stop and then re-engage the starter.

5. Battery: Lead acid, certified to meet NFPA 110, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least three times without recharging.
6. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
7. Battery Stand: Factory-fabricated, two-tier metal with acid-resistant finish designed to hold the quantity of battery cells required and to maintain the arrangement to minimize lengths of battery interconnections.
8. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and continuous rating adequate for batteries provided, 35-A minimum.
9. Battery Charger: Current-limiting, automatic-equalizing and float-charging type designed for lead-acid batteries. Unit shall comply with and be listed to UL 1236 and include the following features:
  - a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
  - b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
  - c. Automatic Voltage Regulation: Maintain +/- 1% constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
  - d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates. Fuse protection. Reverse polarity and transient protected.
  - e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
  - f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet with adequate vibration isolation if mounted within the generator set.

## **2.5 DIESEL FUEL-OIL SYSTEM**

- A. Comply with NFPA 30.
- B. Flexible fuel lines rated 300 deg F and 100 psi ending in pipe thread.
- C. Main Fuel Pump: Mounted on engine to provide primary fuel flow under starting and load conditions. Engine-driven or electric fuel transfer pump capable of lifting fuel 4.7 feet minimum.
- D. Fuel Filtering: Primary fuel filter to remove water and contaminants larger than 10 micron. Secondary filter to remove contaminants larger than 2 micron.
- E. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
- F. Subbase-Mounted, Double-Wall, Fuel-Oil Tank: Factory installed and piped, complying with UL 142 fuel-oil tank. Features include the following:
  1. Fuel-Tank Capacity: Fuel for 72 hours' continuous operation at 100 percent rated power output (200 gallons minimum). Tanks larger than the minimum capacity specified are acceptable.
  2. Tank level indicator gauge.
  3. Low Fuel Sensing Switch: shall be provided, in accordance with NFPA110, to indicate when less than the minimum fuel necessary for full load running, as required by the specified EPSS class.
  4. Leak detection in interstitial space.
  5. Vandal-resistant fill cap.
  6. Spill containment box for filling location.

7. Normal vent shall extend to 12' above grade. Adequately brace extended vent so that attachment of the vent to the tank is not the sole means of support.
8. Containment Provisions: Comply with requirements of authorities having jurisdiction.
9. Tank shall be production tested to 2 psi.
10. Tank shall be equipped with overfill protection, fuel line check valve, fuel level gauge, low fuel level alarm contact, low fuel level shutdown contact, and fittings for fuel supply, return, fill and vent.
11. The tank shall feature all welded construction and have the structural integrity to support the genset, accessories, and the weather-protective enclosure.

## 2.6 CONTROL AND MONITORING

- A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown with a programmed 5-minute cooldown period. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Activation of a remote emergency-stop switch also shuts down generator set. When mode-selector switch is in the OFF position, the engine shall not start even though the remote start contacts close. This position shall also provide for immediate shutdown in case of an emergency. Reset of any fault shall also be accomplished by putting the switch to the OFF position.
- B. Provide minimum run time control set for 15 minutes with override only by switching the model-selector switch to Off or by operation of a remote emergency-stop switch. Provide engine cooldown timer, factory set at 5 minutes, to permit unloaded running of the standby set after transfer of the load to normal.
- C. Comply with UL 508A.
- D. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration. Panel shall be powered from the engine-generator set battery.
  1. Engine and generator control wiring shall be multi-stranded annealed copper conductors encased by cross-linked polyethylene insulation resistant to heat, abrasion, oil, water, diesel fuel, and antifreeze. Wiring shall be suitable for continuous use at 250 deg F (121 deg C) with insulation not brittle at minus 60 deg F (minus 51 deg C). Cables shall be enclosed in nylon flexible conduit, which is slotted to allow easy access and moisture to escape.
    - a. Engines that are equipped with an electronic engine control module (ECM) shall monitor and control engine functionality and seamlessly integrate with the generator set controller through digital communications. ECM monitored parameters shall be integrated into the genset controllers NFPA 110 alarm and warning requirements.
  2. Construction: All circuitry within the control panel shall be individually environmentally sealed to prevent corrosion. Encapsulated circuit boards with surface mounted components and sealed, automotive-style connectors for sensors and circuit board connectors.
- E. Indicating Devices: As required by NFPA 110 for Level 1 system. All ECM fault codes shall be displayed at the generator set controller in standard language; fault code numbers are not acceptable. Utilizing a digital display, including the following:
  1. AC voltage: True three-phase sensing.
  2. AC current.
  3. Frequency.
  4. EPS supplying load indicator.
  5. DC voltage (alternator battery charging).

6. Engine-coolant temperature.
  7. Engine lubricating-oil pressure.
  8. Running-time meter.
  9. Current and Potential Transformers: Instrument accuracy class.
- F. Protective Devices and Controls in Local Control Panel: Shutdown devices and common visual alarm indication as required by NFPA 110 for Level 1 system, including the following:
1. Start-stop switch.
  2. Over-crank shutdown device.
  3. Overspeed shutdown device.
  4. Coolant high-temperature shutdown device.
  5. Coolant low-level shutdown device.
  6. Low lube oil pressure shutdown device.
  7. Over-crank alarm.
  8. Overspeed alarm.
  9. Coolant high-temperature alarm.
  10. Coolant low-temperature alarm.
  11. Coolant low-level alarm.
  12. Low lube oil pressure alarm.
  13. Lamp test.
  14. Contacts for local and remote common alarm.
  15. Coolant high-temperature pre-alarm.
  16. Generator-voltage; digitally adjustable via controller, password protected.
  17. Fuel tank low-level alarm.
  18. Run-Off-Auto switch.
  19. Control switch not in automatic position alarm.
  20. Low cranking voltage alarm.
  21. Battery-charger malfunction alarm.
  22. Battery low-voltage alarm.
  23. Battery high-voltage alarm.
- G. Remote Emergency Shutdown: Provide remote emergency stop switch on external wall of equipment enclosure at a height suitable for installed location.
- H. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.
- I. Data Connection: Provide an RS-485 ModBus port.
- J. The control system shall provide pre-wired customer use dry contact outputs (4 minimum). Customer I/O shall be software configurable providing full access to all alarm, event, data logging, and shutdown functionality. For the initial installation, configure:
1. One relay output shall be configured for a summary indication of pre-alarm / alarm / shutdown conditions.
  2. One relay output shall be configured for RUN indication of the generator.
- K. Programmable Cycle Timer: To start and run the generator for a predetermined time. The timer shall use 14 user-programmable sequences that are repeated in a 7-day cycle. Each sequence shall have the following programmable set points:
1. Day of the week.
  2. Time of the day start.
  3. Duration of cycle.
  4. Option to exercise at reduced speed for quiet test mode.

## **2.7 GENERATOR OVERCURRENT AND FAULT PROTECTION**

- A. Overcurrent protective devices for the entire EPSS shall be coordinated to optimize selective tripping when a short circuit occurs. Coordination of protective devices shall consider both utility and EPSS as the voltage source.
  - 1. Overcurrent protective devices for the EPSS shall be accessible only to authorized personnel.
- B. Generator Circuit Breaker: Molded-case, thermal-magnetic type; 100 percent rated; complying with UL 489.
  - 1. Tripping Characteristic: Designed specifically for generator protection.
  - 2. Trip Rating: Matched to generator output rating.
  - 3. Trip Settings:
    - a. Selected to coordinate with generator thermal damage curve.
    - b. Selected to coordinate with magnetic only, motor circuit protector breaker at a fire pump controller, as applicable.
    - c. The instantaneous trip setting shall not exceed the calculated short circuit fault current available from the generator.
  - 4. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.

## **2.8 GENERATOR, EXCITER, AND VOLTAGE REGULATOR**

- A. Comply with NEMA MG 1 and UL2200, sized for 248 deg F (120 deg C) temperature rise above ambient at rated load.
- B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
- C. Electrical Insulation: Class H, vacuum impregnated with epoxy varnish in accordance with MILSPEC 1-24092 for improved fungus and salt spray resistance.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required. Provide twelve lead alternator.
- E. Range: Provide broad range of output voltage by adjusting the excitation level.
- F. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rated speed, and heat during operation at 110 percent of rated capacity.
- G. Enclosure: Drip-proof.
- H. Instrument Transformers: Mounted within generator enclosure.
- I. Voltage Regulator: Solid-state type on a sealed circuit board, separate from exciter, providing performance as specified and as required by NFPA 110. Must be 3-phase sensing.
  - 1. Voltage Adjustment on Control and Monitoring Panel: Provide plus or minus 10 percent adjustment of output-voltage operating band.
  - 2. Provide anti-hunt provision to stabilize voltage.
  - 3. Isolated to prevent tracking when connected to SCR loads.
- J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- K. Subtransient Reactance: 12 percent, maximum for sites with motor load supplied from VFDs or solid state soft starters.
- L. Excitation: Permanent magnet (PMG) type providing 300 percent current output for up to 10 seconds to a downstream breaker for selective coordination and improved motor starting.

## **2.9 OUTDOOR GENERATOR-SET ENCLOSURE**

- A. Description: Vandal-resistant, sound-attenuating, weatherproof housing, wind resistant up to 140 mph. Roof shall be peaked or sloped for water runoff. Access doors shall be positioned to provide adequate access to components requiring maintenance. Instruments and controls shall be mounted within enclosure.

1. Structural Design and Anchorage: Comply with North Carolina Building Code for wind loads up to 140 mph. Enclosure shall be mounted to the subbase fuel tank
  2. Aluminum alloy, 0.063" thick minimum (14 gauge equivalent).
  3. Enclosure exterior shall be primed and finish coated with finish color as selected by the architect.
  4. Hinged Doors:
    - a. Provide a minimum of two doors per side for operator and service access. A rear door or removable access panel shall provide access to generator end of unit.
    - b. Door Panels: With integral stiffeners, and capable of being removed by one person without tools. In lieu of being removed, hardware that retains doors in fully open position are acceptable.
    - c. Slip-pin hinges and latches stainless steel with nylon spacers.
    - d. Gasketed for weather and rodent protection.
    - e. Handles to have padlocking provisions.
    - f. Door locks, hardware, and fasteners shall be stainless steel. Locks shall be keyed alike
  5. Silencer:
    - a. Located within enclosure.
    - b. Super-critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements. Reference 2.2.D for sound emission requirements.
    - c. Coated to be temperature and rust resistant.
    - d. Integral condensate drain.
    - e. Gas proof, stainless steel, flexible exhaust bellows with threaded NPT or flanged connections.
    - f. All exhaust piping shall be wrapped for personnel protection and to eliminate excessive heat build-up during generator operation.
  6. Assembly Hardware (Nuts and Bolts): Use stainless steel hardware and nylon washers to prevent paint deterioration.
- B. Sound Attenuation: Factory or third party enclosure, designed to meet the following design criteria:
1. Sound attenuated enclosure designed to match the criteria for the silencer. Reference section 2.2.D. Enclosure shall have intake and discharge hoods, as needed, to reduce the mechanical and exhaust noise to an acceptable level.
  2. Sound attenuation materials shall be securely supported, attached, and mechanically held in place; preferably with aluminum perforated metal sheeting.
- C. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.
1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers to prevent entry of rain and snow. Screened openings to prevent rodent entry.
- D. Convenience Outlets: Factory wired, GFCI. Arrange for external electrical connection.
- 2.10 VIBRATION ISOLATION DEVICES**
- A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
- 2.11 SOURCE QUALITY CONTROL**
- A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.
  2. Additionally, test and document the following:

- a. Maximum power (kW).
  - b. Maximum motor starting (kVA) at 35% instantaneous voltage dip.
  - c. Alternator temperature rise by embedded thermocouple and by resistance method per NEMA MG1 -22.40.
  - d. Governor speed regulation under steady-state and transient conditions.
  - e. Voltage regulation and generator transient response.
  - f. Fuel consumption at 1/4, 1/2, 3/4, and full load.
  - g. Harmonic analysis, voltage waveform deviation, and telephone influence factor.
  - h. Three-phase short circuit tests.
  - i. Alternator cooling air flow.
  - j. Torsional analysis testing to verify that the generator set is free of harmful torsional stresses.
  - k. Endurance testing.
- B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
- 1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
  - 2. Test generator, exciter, and voltage regulator as a unit.
  - 3. Full load run.
  - 4. Maximum power.
  - 5. Voltage regulation.
  - 6. Transient and steady-state governing.
  - 7. Single-step load pickup.
  - 8. Safety shutdown.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.
- B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 DELIVERY**

- A. Generator equipment shall be shipped to the site as a "single-source" item for which responsibility for overall installation, maintenance, spare parts, and service is through the local factory representative.
- B. Delivery of the generator shall include off-loading and setting the generator in place on a concrete slab. Installation shall include mounting of all accessories specified elsewhere in this specification along with external power and control connections of the unit.

#### **3.3 INSTALLATION**

- A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.
- B. Equipment Mounting:
  - 1. Install packaged engine generators on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified and/or as detailed in the drawings.
  - 2. Coordinate size and location of concrete bases for packaged engine generators. Cast anchor-bolt inserts into bases.

- C. Install packaged engine-generator to provide access, without removing connections or accessories, for periodic maintenance.
- D. Install engine-generator in enclosure with elastomeric isolator pads on concrete base. Secure set as required by the manufacturer.
- E. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.
- F. Provide fuel as required for startup, testing, and demonstration.

### **3.4 CONNECTIONS**

- A. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine-generator to allow service and maintenance.
- B. Connect engine exhaust pipe to engine with flexible connector.
- C. Ground equipment according to Section "Grounding and Bonding."
- D. Connect wiring according to Section "Conductors and Cable." Provide a minimum of one 90 degree bend in flexible conduit routed to the generator set from a stationary element.

### **3.5 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Tests and Inspections:
  - 1. NFPA 30 Fuel Tank Tightness Testing:
    - a. After installation on site and before being placed into service, the fuel tank and connections shall be tested in accordance with NFPA 30 requirements.
    - b. Notify the Design Team and local AHJ and Fire Marshal two weeks prior to scheduled test date to allow observation of the testing.
    - c. Obtain written acceptance of testing from the local AHJ and Fire Marshal.
    - d. Submit two copies of local AHJ and Fire Marshal written acceptance of testing.
  - 2. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in the first two subparagraphs as specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
    - a. Visual and Mechanical Inspection
      - 1) Compare equipment nameplate data with drawings and specifications.
      - 2) Inspect physical and mechanical condition.
      - 3) Inspect anchorage, alignment, and grounding.
      - 4) Verify the unit is clean.
      - 5) Provide fluids and check levels of fuel, lubricating oil, and antifreeze for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.
      - 6) Accessories that normally function while each set is standing by shall be checked prior to cranking the engines. These shall include: block heaters, battery chargers, etc.
    - b. Electrical and Mechanical Tests
      - 1) Test protective relay devices per manufacturer recommendations.
      - 2) Verify phase rotation, phasing, and synchronized operation as required by the application.
      - 3) Start-up test mode to check for exhaust leaks, path of exhaust gases outside buildings, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage, and phase rotation.
      - 4) Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.
      - 5) Conduct performance test in accordance with NFPA 110.
      - 6) Verify correct functioning of the governor and regulator.

- 7) Four hour load bank test with an external load bank as follows: 1 hour @ 50% load, 3 hours @ 100% load. Monitor and record the following data in 15 minute intervals: engine coolant temperature, oil pressure, battery charge level, generator output voltage, amperes, and frequency.
3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
  - a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
  - b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
  - c. Verify acceptance of charge for each element of the battery after discharge.
  - d. Verify that measurements are within manufacturer's specifications.
4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks. Repair leaks and retest until no leaks exist.
6. Voltage and Frequency Transient Stability Tests:
  - a. Use data capture from manufacturer control panel and software for measurements.
  - b. Measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
  - c. Measure voltage and frequency transients for actual site loads, similar to the steps indicated for voltage drop calculation requirements.
- C. Coordinate tests with tests for transfer switches and run them concurrently. Perform automatic start-up by means of simulated power outage to test remote-automatic starting, transfer of the load, and automatic shutdown.
- D. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.
- E. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- F. Remove and replace malfunctioning units and retest as specified.
- G. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- H. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

### **3.6 MAINTENANCE SERVICE**

- A. After the four hour load bank test has been completed:
  1. Change the lubrication oil, lubrication oil filters, and fuel filters.
  2. Fill fuel tank.
- B. Under the service contract, provide full service and maintenance by certified employees of manufacturer's designated service organization.
  1. Quarterly: Include inspection, testing, exercising, and adjustments to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation.
  2. Yearly: Along with quarterly activities, include a load bank test for a minimum of 3 hours at 100% load.
  3. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

4. Include certification in the Owner's maintenance log of repairs made and proper functioning of all engine and auxiliary systems.

### **3.7 TRAINING**

- A. The equipment supplier shall provide training for the facility operating personnel covering operation, maintenance, and repair of the equipment provided. The training program shall be not less than 4 hours in duration and the class size shall be limited to 5 persons. Training date shall be coordinated with the facility owner. Time permitting, training will be tentatively scheduled after start-up.

**END OF SECTION**

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**SECTION 26 3600**  
**TRANSFER SWITCHES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes transfer switches rated 600 V and less, including the following:
  - 1. Automatic transfer switches (ATS), closed transition type

**1.3 SUBMITTALS**

- A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings:
  - 1. Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.
  - 2. Wiring diagrams.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified elsewhere for operation and maintenance Data, include the following:
  - 1. Features and operating sequences, both automatic and manual.
  - 2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

**1.4 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than four hours from time of notification.
- B. Source Limitations: Obtain automatic transfer switches through one source from a single manufacturer.
- C. Comply with NEMA ICS 1.
- D. Comply with NFPA 70.
- E. Comply with NFPA 110.
- F. Comply with UL 1008 unless requirements of these Specifications are stricter.

**1.5 WARRANTY**

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of transfer switch or transfer switch components that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Two years from date of Owner Acceptance.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Contactor Transfer Switches:
    - a. Emerson; ASCO Power Technologies, LP.
    - b. ABB / GE / Zenith Controls.

- c. Russelectric, Inc.

## **2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS**

- A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
- B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
  - 1. Rating: 10,000 AIC.
- C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.
- D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- E. Electrical Operation: Accomplish by a non-fused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.
- F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
  - 1. Switch Action: Double throw; mechanically held in both directions.
  - 2. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.
- G. Neutral Switching. Where four-pole switches are indicated for 3-phase distribution systems and three-pole switches are indicated for single phase distribution system, provide neutral pole switched simultaneously with phase poles.
- H. Heater: Equip switches exposed to outdoor temperatures and humidity, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.
- I. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are specified in Section "Electrical Identification."
  - 1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
  - 2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
  - 3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
- J. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

## **2.3 AUTOMATIC TRANSFER SWITCHES**

- A. Comply with Level 2 equipment according to NFPA 110.
- B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.
- C. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.
- D. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.
- E. Automatic Closed-Transition Transfer Switches: Include the following functions and characteristics:
  - 1. Fully automatic make-before-break operation.

2. Load transfer without interruption, through momentary interconnection of both power sources not exceeding 100 ms.
  3. Initiation of No-Interruption Transfer: Controlled by in-phase monitor and sensors confirming both sources are present and acceptable.
    - a. Initiation occurs without active control of generator.
    - b. Controls ensure that closed-transition load transfer closure occurs only when the 2 sources are within plus or minus 5 electrical degrees maximum, and plus or minus 5 percent maximum voltage difference.
  4. Failure of power source serving load initiates automatic break-before-make transfer.
  5. Comply with Duke Energy interconnection requirements:
    - a. Include synchronization check function (25 relay).
    - b. Include a separate timer that initiates separation of the backup supply source from the utility if the paralleling time exceeds 100 ms.
    - c. See attached Figures 73A and 74 from Duke Energy document Requirements for Electric Service and Meter Installations, North Carolina and South Carolina.
- F. Automatic Transfer-Switch Features:
1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
  2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
  3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
  4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
  5. Test Switch: Simulate normal-source failure.
  6. Switch-Position Pilot Lights: Indicate source to which load is connected.
  7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
    - a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
    - b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
  8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
  9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
  10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
  11. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
  12. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

- a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
- b. Push-button programming control with digital display of settings.
- c. Integral battery operation of time switch when normal control power is not available.

## **2.4 SOURCE QUALITY CONTROL**

- A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Floor-Mounting Switch: Anchor to floor by bolting.
  - 1. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 4 inches (100 mm) in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support.
- B. Identify components according to Section "Electrical Identification."
- C. Set field-adjustable intervals and delays, relays, and engine exerciser clock.
- D. Label transfer switch with short circuit current rating information as required by NEC 702.5.

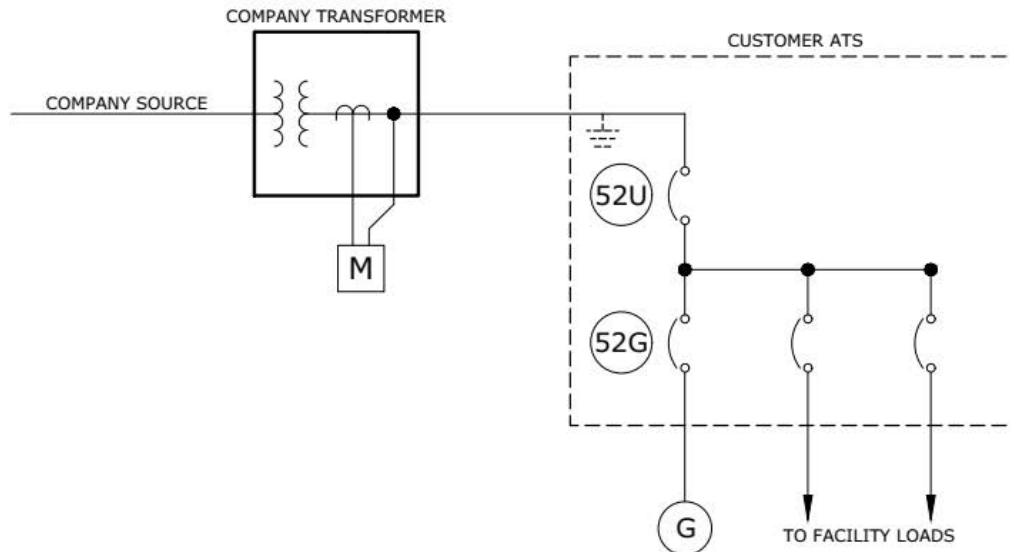
### **3.2 CONNECTIONS**

- A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner, if necessary to accommodate required wiring.
- B. Ground equipment according to Section "Grounding and Bonding".
- C. Connect wiring according to Section "Conductors and Cables".

### **3.3 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
  - 1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
  - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
    - a. Check for electrical continuity of circuits and for short circuits.
    - b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
    - c. Verify that manual transfer warnings are properly placed.
    - d. Perform manual transfer operation.
  - 4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
    - a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
    - c. Verify time-delay settings.

- d. Verify pickup and dropout voltages by data readout or inspection of control settings.
    - e. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
  - 5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
    - a. Verify grounding connections and locations and ratings of sensors.
  - C. Coordinate tests with tests of generator and run them concurrently.
  - D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
  - E. Remove and replace malfunctioning units and retest as specified above.
- 3.4 DEMONSTRATION**
  - A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below.
  - B. Coordinate this training with that for generator equipment.



# **LEGEND:**

**(G)** GENERATOR

**(M)** METER

**ATS** AUTO-TRANSFER SWITCH

**(52U)** UTILITY-SIDE BREAKER WITH LOCKABLE OPEN FEATURE

**(52G)** GENERATOR-SIDE BREAKER



GROUNDING PROVISION PROVIDED BY CUSTOMER TO MEET THE FOLLOWING SPECIFICATIONS:

- A. ACCESSIBLE TO COMPANY PERSONNEL
- B. 10' CLEARANCE
- C. GROUND BALL STUD(S) ON EACH PHASE AND NEUTRAL
  - 1. MOUNTED IN HORIZONTAL POSITION
  - 2. 25MM OR 30MM DIAMETER
  - 3. 4" MIN. LENGTH, INCLUDING BALL
  - 4. FAULT CURRENT RATED FOR GEAR BUSS.
  - 5. MULTIPLE GROUND BALL STUDS MAY BE NEEDED TO MEET AVAILABLE FAULT CURRENT.

3				
2				
1	2/29/24	SHAFFER	EANES	GRAHAM
0	10/28/15	SIMPSON	SIMPSON	ADCOCK
REVISED	BY	CHK'D	APPR.	

**SERVICE WITH STANDBY GENERATION  
AUTO TRANSFER SWITCH  
PARALLEL (>100 MILLISECONDS)  
TOTAL FACILITY LOAD**



DEC	DEM	DEP	DEF
X	X	X	
<b>FIG 73A</b>			

### **INTERCONNECTION EVALUATION**

SYSTEMS IN THIS CATEGORY REQUIRE APPROVAL IN WRITING FROM DUKE ENERGY BEFORE BEING CONNECTED. SPECIFICALLY, INTERCONNECTION OF GENERATING FACILITIES IN THIS CATEGORY MUST BE EVALUATED AND APPROVED BY THE DISTRIBUTION PROTECTION AUTOMATION AND CONTROL GROUP WITHIN DUKE ENERGY.

### **INTERCONNECTION PROTECTION (RELAYING) REQUIREMENTS**

FOR INTERCONNECTION PROTECTION, THE GENERATING FACILITY'S INTERCONNECTION EQUIPMENT MUST EITHER BE LISTED AS FULLY COMPLIANT WITH UL1741 (FOR INVERTER-BASED EQUIPMENT) OR MUST BE COMPLIANT WITH IEEE 1547 SECTION 4 (INTERCONNECTION TECHNICAL SPECIFICATIONS AND REQUIREMENTS); VOLTAGE AND FREQUENCY SET-POINTS MUST BE SAME AS "DEFAULT" UNLESS OTHERWISE APPROVED BY DUKE ENERGY. ADDITIONAL REQUIREMENTS ARE LISTED BELOW:

1. THE DER UNIT SHALL PARALLEL WITH THE COMPANY DISTRIBUTION SYSTEM WITHOUT CAUSING A VOLTAGE FLUCTUATION AT THE POD GREATER THAN +/-5% OF THE PREVAILING VOLTAGE LEVEL OF THE COMPANY DISTRIBUTION SYSTEM AT THE POD. (IEEE 1547-2003 SECTION 4.1.3 SYNCHRONIZATION)
2. THE DER UNIT SHALL NOT ENERGIZE THE COMPANY DISTRIBUTION SYSTEM WHEN THE COMPANY DISTRIBUTION SYSTEM IS DE-ENERGIZED. (IEEE 1547-2003 SECTION 4.1.5 INADVERTENT ENERGIZATION OF THE COMPANY DISTRIBUTION SYSTEM)
3. SERVICE ENTRANCE DISCONNECTING EQUIPMENT WITH VISIBLE OPEN CAPABILITY AND GROUNDING PROVISIONS. THIS INCLUDES THE ABILITY TO LOCK OPEN OR "RACK-OUT" THEIR UTILITY BREAKER OR SERVICE ENTRANCE DISCONNECT.
4. THE INTERCONNECTION EQUIPMENT MUST HAVE A SYNCHRONIZATION CHECK FUNCTION (25 RELAY).
5. THE INTERCONNECTION EQUIPMENT MUST HAVE A SEPARATE TIMER THAT WILL INITIATE THE SEPARATION OF THE GENERATOR AND THE UTILITY IF THE PARALLELING TIME EXCEEDS 100MS.
6. THE DER UNIT SHALL NOT BACK FEED (INTENDED OR NON-INTENDED) THE UTILITY SYSTEM.
7. CUSTOMER MUST PROVIDE A DOCUMENT STAMPED BY A LICENSED PROFESSIONAL ENGINEER (LICENSED IN THE STATE WHERE THE GENERATING FACILITY IS TO BE LOCATED) SHOWING APPROVAL OF CUSTOMER'S DESIGN AND TESTING OF SYSTEM OPERATION MEETS DUKE ENERGY REQUIREMENTS FOR MOMENTARY PARALLEL OPERATION.
8. CUSTOMER MUST SIGN AN INTERCONNECTION AGREEMENT BEFORE MOMENTARY PARALLEL OPERATION IS ALLOWED.

3				
2				
1	2/29/24	SHAFFER	EANES	GRAHAM
0	7/2/15	VALENTIN	SIMPSON	ADCOCK
REVISED	BY	CHK'D	APPR.	

STANDBY GENERATION - PROTECTION REQUIREMENTS  
MOMENTARY PARALLEL GENERATION  
(FAST TRANSITION  $\leq 100$  MILLISECONDS PARALLEL TIME)

			
DEC	DEM	DEP	DEF
X	X	X	
FIG 74			

END OF SECTION

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**SECTION 26 4313**  
**SURGE PROTECTIVE DEVICES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes UL 1449 Type 2 surge protective devices for low-voltage power.

**1.3 SUBMITTALS**

- A. Product Data: For each type of product indicated. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.
- B. Product Certificates: Signed by manufacturers of surge protective devices, certifying that products furnished comply with the following testing and labeling requirements:
  - 1. UL 1283 certification.
  - 2. UL 1449 listing and classification.
- C. Maintenance Data: For surge protection devices to include in maintenance manuals.
- D. Warranties: Special warranties specified in this Section.

**1.4 QUALITY ASSURANCE**

- A. Source Limitations: Obtain suppression devices and accessories through one source from a single manufacturer.
- B. IEEE Compliance: Comply with:
  - 1. IEEE C62.41.1, "Guide on the Surge Environment in Low-Voltage (1000V and less) AC Power Circuits".
  - 2. IEEE C62.41.2, "Recommended Practice on Characterization of Surges in Low-Voltage (1000V and less) AC Power Circuits".
  - 3. IEEE C62.45, "Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and less) AC Power Circuits".
  - 4. IEEE C62.72, "Guide for the Application of Surge Protective Devices for Low-Voltage (1000V and less) AC Power Circuits".
  - 5. IEEE C62.45, "Standard Test Specifications for Surge Protective Devices for Low-Voltage (1000V and less) AC Power Circuits".
- C. NEC Compliance: Comply with NEC 285, "Surge Protective Devices".
- D. UL Compliance: Comply with:
  - 1. UL 1283, "Electromagnetic Interference Filters".
  - 2. UL 1449, "Transient Voltage Surge Suppressors": latest edition.

**1.5 PROJECT CONDITIONS**

- A. Placing into Service: Do not energize or connect service entrance equipment and panelboards to their sources until the surge protective devices are installed and connected.

**1.6 COORDINATION**

- A. Verify voltage rating of system to be protected by surge protective device.
- B. Coordinate location of field-mounted surge suppressors to allow adequate clearances for maintenance.

**1.7 WARRANTY**

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in

addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

- B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of surge suppressors that fail in materials or workmanship within 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. ABB / Current Technology, Inc.
  - 2. ASCO.
  - 3. Thor Systems, Inc.

### **2.2 SERVICE ENTRANCE SUPPRESSORS**

- A. Manufacturer Series:
  - 1. ABB / Current Technology #TG3 Series.
  - 2. Eaton SMP Series
  - 3. Siemens TPS4\_12 Series.
  - 4. Thor Systems #TSri Series.
- B. Include the following features and accessories:
  - 1. LED indicator lights for power and protection status.
  - 2. Surge Rating: 100kA per mode / 200KA per phase.
  - 3. ANSI / UL 1449 VPR:
    - a. 120/208V: 800V maximum (L-N, L-G, N-G), 1200V maximum (L-L).
  - 4. Enclosures: NEMA 1.
  - 5. Surge-event operations counter.
- C. Connection Means: Permanently wired.
- D. Protection modes:
  - 1. Line to Line.
  - 2. Line to Neutral.
  - 3. Line to Ground.
  - 4. Neutral to Ground.

### **2.3 PANELBOARD SUPPRESSORS**

- A. Manufacturer Series:
  - 1. ABB / Current Technology #CGP Series.
  - 2. Eaton SMP Series.
  - 3. Siemens TPS4\_12 Series.
  - 4. Thor Systems #TSni Series.
- B. Include the following features and accessories:
  - 1. LED indicator lights for power and protection status.
  - 2. Surge Rating: 50kA per mode.
  - 3. ANSI / UL 1449 VPR:
    - a. 120/208V: 800V maximum (L-N, L-G, N-G), 1200V maximum (L-L).
    - b. 277/480V: 1200V maximum (L-N, L-G, N-G), 2000V maximum (L-L).
  - 4. Enclosures: NEMA 1.
  - 5. Surge-event operations counter.
- C. Connection Means: Permanently wired.
- D. Protection modes:
  - 1. Line to Neutral.
  - 2. Line to Ground.

3. Neutral to Ground.

## **2.4 ENCLOSURES**

- A. NEMA 250, with type matching the enclosure of panel or device being protected.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION OF SURGE PROTECTIVE DEVICES**

- A. Install devices at service entrance on load side, with ground lead bonded to service entrance ground. Use conductors between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length.
  1. Provide multipole, 60-A circuit breaker as a dedicated disconnect for the suppressor, unless otherwise indicated
- B. Install devices for panelboards with conductors between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
  1. Provide multipole, 30-A circuit breaker as a dedicated disconnect for the suppressor, unless otherwise indicated.

### **3.2 CONNECTIONS**

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### **3.3 FIELD QUALITY CONTROL**

- A. Testing: Perform the following field quality-control testing:
  1. After installing surge protective devices, but before electrical circuitry has been energized, test for compliance with requirements.
  2. Complete startup checks according to manufacturer's written instructions.
- B. Repair or replace malfunctioning units. Retest after repairs or replacements are made.

**END OF SECTION**

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**SECTION 26 5119**  
**LED INTERIOR LIGHTING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section includes interior LED luminaires, LED luminaires mounted on exterior building surfaces, materials, finishes, supports.
- B. Related Requirements:
  - 1. Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting contactors.

**1.3 DEFINITIONS**

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Arrange in order of luminaire callout designation.
  - 2. Include data on features, accessories, and finishes.
  - 3. Include physical description and dimensions of luminaires.
  - 4. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
  - 5. Include emergency lighting units, including batteries, chargers, photometric performance data.
- B. Shop Drawings: For nonstandard or custom luminaires.
  - 1. Include plans, elevations, sections, and mounting and attachment details.
  - 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include diagrams for power, signal, and control wiring.
- C. Photometric data of type P and type MS lights in Children's Bookstacks 118 and Adult Bookstacks 131.

**1.5 INFORMATIONAL SUBMITTALS**

- A. Sample warranty.

**1.6 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

**1.7 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. LED Arrays: Three for every 100 of each type and rating installed. Furnish at least one of each type.

2. LED Drivers: Three for every 100 of each type and rating installed. Furnish at least one of each type.
3. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: One for every 50 of each type and rating installed. Furnish at least one of each type.

If field replaceable components are not available, furnish at least one fixture of each type in lieu of the extra materials noted above.

## **1.8 QUALITY ASSURANCE**

- A. Provide luminaires from a single manufacturer for each luminaire type.
- B. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

## **1.9 DELIVERY, STORAGE, AND HANDLING**

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

## **1.10 WARRANTY**

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: 5 years from date of Substantial Completion

# **PART 2 - PRODUCTS**

## **2.1 LUMINAIRE REQUIREMENTS**

- A. Standards:
  1. Design Lights Consortium (DLC) qualified products list or ENERGY STAR certified.
  2. UL 1598, Standard for Luminaires.
  3. Recessed luminaires shall comply with NEMA LE 4.
  4. UL Listing: Listed for damp or wet location as applicable.
- B. CRI minimum of 80 CCT.
- C. Rated lamp life of 50,000 hours minimum to L70.
- D. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- E. Internal driver.
- F. Input Voltage Tolerance: +/- 10% of nominal rated voltage.

## **2.2 RECESSED CAN DOWNLIGHT**

- A. Universal mounting bracket.
- B. Fully serviceable from below the ceiling.
- C. Integral junction box with conduit fittings.
- D. Fixtures installed in the building thermal envelope shall be:
  1. IC rated.
  2. Labeled as having an air leakage rate of not more than 2.0 cfm when tested in accordance with ASTM E283 at a 1.57 psf pressure differential.
  3. Sealed with a gasket between the housing and interior wall or ceiling covering.

## **2.3 EMERGENCY LIGHTING UNITS**

- A. General: Self-contained units complying with UL 924.
  1. LED lamp heads.
  2. Battery: Sealed, maintenance-free, nickel-cadmium or nickel metal hydride type with minimum 10-year nominal life and special warranty. Battery sized to provide emergency illumination for not less than 90 minutes.

3. Charger: Fully automatic, solid-state type with sealed transfer relay.
4. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
5. Protective Guard: Where indicated, clear polycarbonate guard protects lamp heads or fixtures.
6. Integral Time-Delay Relay: Holds unit on for fixed interval when power is restored after an outage; time delay permits high-intensity-discharge lamps to restrike and develop adequate output.

## **2.4 EXIT SIGNS**

- A. General: Comply with UL 924; for sign colors and lettering size, comply with authorities having jurisdiction.
- B. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum of rated lamp life.
- C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
  1. Battery: Sealed, maintenance-free, nickel-cadmium or nickel metal hydride type with special warranty. Battery sized to provide emergency illumination for not less than 90 minutes.
  2. Charger: Fully automatic, solid-state type with sealed transfer relay.
  3. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

## **2.5 MATERIALS**

- A. Metal Parts:
  1. Free of burrs and sharp corners and edges.
  2. Sheet metal components shall be steel unless otherwise indicated.
  3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit re-lamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position.

## **2.6 METAL FINISHES**

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

## **2.7 LUMINAIRE SUPPORT**

- A. Comply with requirements in Section "Basic Materials and Methods" for channel and angle iron supports.
- B. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gauge.
- D. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gauge.
- E. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- F. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
  - 1. Sized and rated for luminaire weight.
  - 2. Able to maintain luminaire position after cleaning and relamping.
  - 3. Provide support for luminaire without causing deflection of ceiling or wall.
  - 4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.
- E. Flush-Mounted Luminaire Support:
  - 1. Secured to outlet box.
  - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
  - 3. Trim ring flush with finished surface.
- F. Wall-Mounted Luminaire Support:
  - 1. Attached to structural members in walls or a minimum 20 gauge backing plate attached to structure.
- G. Suspended Luminaire Support:
  - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
  - 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
  - 3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing for suspension for each unit length of luminaire chassis, including one at each end.
  - 4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- H. Ceiling-Grid-Mounted Luminaires:
  - 1. Fixture is to be supported at two (2) opposite ends to the steel frame of the building using the same type of wire as used to support the lay-in ceiling track.
  - 2. Support Clips:
    - a. Fasten fixtures to ceiling grid main runner members with manufacturer clips.
  - 3. Fixtures of Sizes Less Than Ceiling Grid Pattern:
    - a. Install as indicated on reflected ceiling plans or center in acoustical panel.
    - b. Support fixtures independently with at least two 3/4-inch (metal channels spanning and secured to ceiling tees.
    - c. Fixture is to be supported at two (2) opposite ends to the steel frame of the building using the same type of wire as used to support the lay-in ceiling track.
  - 4. Luminaire support wires shall be color coded and tagged to be distinguishable from the grid support wires.

### **3.3 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories; and after electrical circuitry has been energized, test units to confirm proper operation.
  2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to battery power source and retransfer to normal. Perform a test on each unit after it is permanently installed and charged for a minimum of 24 hours. Battery shall be tested for 90 minutes. The battery test shall demonstrate compliance with the requirements of NEC 700.12(I). Repair and/or replace any units that fail the test, then retest.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Corroded Fixtures: During warranty period, replace fixtures that show any signs of corrosion.

**END OF SECTION**

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**SECTION 27 1500**  
**COMMUNICATIONS HORIZONTAL CABLING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Pathways.
  - 2. UTP cabling.
  - 3. Multiuser telecommunications outlet assemblies.
  - 4. Cable connecting hardware and patch panels.
  - 5. Telecommunications outlet/connectors.
  - 6. Cabling system identification products.
  - 7. Cable management system.
- B. Related Sections:
  - 1. Section "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.

**1.3 DEFINITIONS**

- A. BICSI: Building Industry Consulting Service International.
- B. EMI: Electromagnetic interference.
- C. IDC: Insulation displacement connector.
- D. LAN: Local area network.
- E. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
- F. RCDD: Registered Communications Distribution Designer.
- G. UTP: Unshielded twisted pair.

**1.4 HORIZONTAL CABLING DESCRIPTION**

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the patch panel located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.
  - 1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
  - 2. Bridged taps and splices shall not be installed in the horizontal cabling.
- B. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment. The maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) in the horizontal cross-connect.

**1.5 PERFORMANCE REQUIREMENTS**

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

**1.6 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
  - 1. System Labeling Schedules: Electronic copy of labeling schedules.

2. Cabling administration drawings and printouts.
  3. Patch panels. Detail mounting assemblies and show elevations and physical relationship between the installed components.
- C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.
- D. Field quality-control reports.
- E. Maintenance Data: For splices and connectors to include in maintenance manuals.

## **1.7 QUALITY ASSURANCE**

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
1. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings, and field testing program development by an RCDD.
  2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- D. Grounding: Comply with ANSI-J-STD-607-A.

## **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Test cables upon receipt at Project site.
1. Test each pair of UTP cable for open and short circuits.

## **1.9 PROJECT CONDITIONS**

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

## **1.10 COORDINATION**

- A. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

## **1.11 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. Patch-Panel Units: One of each type.

# **PART 2 - PRODUCTS**

## **2.1 PATHWAYS**

- A. General Requirements: Comply with TIA/EIA-569-A.
- B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
1. Support brackets with cable tie slots for fastening cable ties to brackets.
  2. Lacing bars, spools, J-hooks, and D-rings.
  3. Straps and other devices.
- C. Conduit and Boxes: Comply with requirements in Section "Raceway and Boxes."
1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

## **2.2 BACKBOARDS**

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm).

## **2.3 UTP CABLE**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Belden CDT Inc.; Electronics Division.
  - 2. Berk-Tek; a Nexans company.
  - 3. CommScope, Inc.
  - 4. Draka USA.
  - 5. Genesis Cable Products; Honeywell International, Inc.
  - 6. KRONE Incorporated.
  - 7. Mohawk; a division of Belden CDT.
  - 8. Molex Premise Networks; a division of Molex, Inc.
  - 9. Nordex/CDT; a subsidiary of Cable Design Technologies.
  - 10. Superior Essex Inc.
  - 11. SYSTIMAX Solutions; a CommScope, Inc. brand.
  - 12. 3M.
  - 13. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
- B. Description: 100-ohm, 4-pair UTP, covered with a blue thermoplastic jacket.
  - 1. Comply with ICEA S-90-661 for mechanical properties.
  - 2. Comply with TIA/EIA-568-B.1 for performance specifications.
  - 3. Comply with TIA/EIA-568-B.2, Category 6.
  - 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
    - a. Communications, General Purpose: Type CM or CMG.
    - b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
    - c. Communications, Riser Rated: Type CMR, complying with UL 1666.
    - d. Communications, Limited Purpose: Type CMX.
    - e. Multipurpose: Type MP or MPG.
    - f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
    - g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

## **2.4 UTP CABLE HARDWARE**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. American Technology Systems Industries, Inc.
  - 2. Dynacom Corporation.
  - 3. Hubbell Premise Wiring.
  - 4. KRONE Incorporated.
  - 5. Leviton Voice & Data Division.
  - 6. Molex Premise Networks; a division of Molex, Inc.
  - 7. Nordex/CDT; a subsidiary of Cable Design Technologies.
  - 8. Panduit Corp.
  - 9. Siemon Co. (The).
  - 10. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
- B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- C. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
  - 1. Number of Jacks per Field: One for each four-pair conductor group of cables, plus spares and blank positions adequate to suit specified expansion criteria.
- D. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.

- E. Patch Cords: Factory-made, four-pair cables in 48-inch (1200-mm) lengths; terminated with eight-position modular plug at each end.
  - 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.

## **2.5 TELECOMMUNICATIONS OUTLET/CONNECTORS**

- A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.
- B. Workstation Outlets:
  - 1. Two-port-connector assemblies mounted in single faceplate.
  - 2. Four-port-connector assemblies mounted in multigang faceplate.
  - 3. See drawings for other outlet quantities for number of ports. Mount assemblies in multigang faceplate.
  - 4. Metal Faceplate: Stainless steel, complying with requirements in Section "Wiring Devices."
  - 5. For use with snap-in jacks accommodating any combination of UTPwork area cords.
    - a. Flush mounting jacks.
  - 6. Legend: Snap-in, clear-label covers and machine-printed paper inserts.

## **2.6 GROUNDING**

- A. Comply with requirements in Section "Grounding and Bonding" for grounding conductors and connectors.
- B. Comply with ANSI-J-STD-607-A.

## **2.7 IDENTIFICATION PRODUCTS**

- A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Section "Electrical Identification."

## **2.8 SOURCE QUALITY CONTROL**

- A. Factory test UTP cables on reels according to TIA/EIA-568-B.1.
- B. Factory test UTP cables according to TIA/EIA-568-B.2.
- C. Cable will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

# **PART 3 - EXECUTION**

## **3.1 WIRING METHODS**

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and attics, where unenclosed wiring method may be used. Conceal raceway except in unfinished spaces.
  - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
- B. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

## **3.2 INSTALLATION OF PATHWAYS**

- A. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.
- B. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

- C. Comply with requirements in Section "Raceway and Boxes" for installation of conduits and wireways.
- D. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- E. Pathway Installation in Communications Equipment Rooms:
  - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
  - 2. Install cable trays to route cables if conduits cannot be located in these positions.
  - 3. Secure conduits to backboard when entering room from overhead.
  - 4. Extend conduits 6 inches (152 mm) above finished floor.
  - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- F. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

### **3.3 INSTALLATION OF CABLES**

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
  - 1. Comply with TIA/EIA-568-B.1.
  - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
  - 3. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
  - 4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
  - 5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
  - 6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
  - 7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
  - 8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
  - 9. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
  - 10. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- C. UTP Cable Installation:
  - 1. Comply with TIA/EIA-568-B.2.
  - 2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
- D. Open-Cable Installation:
  - 1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
  - 2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.
  - 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- E. Group connecting hardware for cables into separate logical fields.
- F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
3. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
4. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

### **3.4 FIRESTOPPING**

- A. Comply with requirements in Section "Firestopping."
- B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

### **3.5 GROUNDING**

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

### **3.6 IDENTIFICATION**

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section "Electrical Identification."
- B. Paint plywood backboards white. Comply with requirements in Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over one manufacturer's label on each sheet.
- C. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- D. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.
- E. Cable and Wire Identification:
  1. Label each cable within 4 inches (100 mm) of each termination, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
  2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.

3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 30 feet (9 m).
  4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
    - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
    - b. Label each unit and field within distribution racks and frames.
  5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- F. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.
1. Cables use flexible vinyl or polyester that flex as cables are bent.

### **3.7 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
- B. Tests and Inspections:
  1. Visually inspect UTP cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
  2. Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.
  3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
  4. UTP Performance Tests:
    - a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:
      - 1) Wire map.
      - 2) Length (physical vs. electrical, and length requirements).
      - 3) Insertion loss.
      - 4) Near-end crosstalk (NEXT) loss.
      - 5) Power sum near-end crosstalk (PSNEXT) loss.
      - 6) Equal-level far-end crosstalk (ELFEXT).
      - 7) Power sum equal-level far-end crosstalk (PSELFEXT).
      - 8) Return loss.
      - 9) Propagation delay.
      - 10) Delay skew.
- C. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- D. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

### **3.8 DEMONSTRATION**

- A. Train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets.

### **END OF SECTION**

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**SECTION 28 3111**  
**DIGITAL, ADDRESSABLE FIRE ALARM SYSTEM**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SYSTEM DESCRIPTION**

- A. Microprocessor controlled, intelligent reporting fire detection and alarm system.

**1.3 SUMMARY**

- A. Section Includes:
  - 1. Fire-alarm control unit / fire alarm panel.
  - 2. Manual fire-alarm boxes.
  - 3. System smoke detectors.
  - 4. Notification appliances.
  - 5. Remote annunciators.
  - 6. Addressable interface device.
  - 7. Power supplies.
  - 8. Digital alarm communicator transmitter.

**1.4 DEFINITIONS**

- AHJ Authority Having Jurisdiction.
- AHU Air Handler Unit.
- LED Light-emitting diode.
- NICET National Institute for Certification in Engineering Technologies.
- NRTL Nationally Recognized Testing Laboratory.

**1.5 PERFORMANCE REQUIREMENTS**

- A. Comply with applicable provisions of the North Carolina State Building Code.
- B. Comply with applicable provisions of NFPA 72, National Fire Alarm Code.
- C. Equipment supplied shall be specifically listed for its intended use and shall be installed in accordance with the manufacturer's instructions.

**1.6 QUALITY ASSURANCE**

- A. Manufacturer's Qualifications:
  - 1. Firms shall be regularly engaged in the manufacture of fire alarm systems of the types, sizes, and electrical characteristics required for this project.
  - 2. The system shall comply with provisions of UL safety standards pertaining to fire detection and alarm systems. Products and components shall be Listed and Labeled.
  - 3. Fire detection and alarm systems and accessories shall be FM approved.
  - 4. Firms shall maintain factory authorized service organization. Firms shall maintain spare parts stock.
- B. Designer for Preparation of Shop Drawings and Calculations Qualifications:
  - 1. Personnel shall be trained and certified by manufacturer for system design required for this Project.
  - 2. Personnel shall be certified by NICET as fire-alarm Level III (minimum) technician.
- C. Installer Qualifications:
  - 1. Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

2. Supervisor of installation shall be certified by NICET as fire-alarm Level II (minimum) technician.
  3. Supervisor of installation shall be certified as an authorized representative of the equipment manufacturer.
  4. Minimum of 5 years of experience installing fire detection and alarm systems similar in size and scope to this project.
- D. Manufacturer's Field Service Technician Qualifications:
1. Personnel shall be certified by NICET as fire-alarm Level II (minimum) technician.
  2. Personnel shall be trained and certified by manufacturer for installation of units specifically required for this Project within the most recent 24 months.
  3. If not trained by the manufacturer within 24 months (as noted in 2 above), but within 36 months, NICET fire alarm Level III (minimum) technician certification is required.
- E. Source Limitations for Fire-Alarm System and Components:
1. Obtain fire-alarm system equipment and components from a single source.
  2. For facilities with existing functional systems in place, new components shall be compatible and listed for use with, and operate as, an extension of existing system.
- F. 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 SUBMITTALS

- A. Qualification Data:
1. Designer:
    - a. Manufacturer training certification.
    - b. NICET certification
  2. Installer:
    - a. Manufacturer training certification.
    - b. NICET certification.
    - c. Authorized representative of equipment manufacturer certification.
    - d. Experience documentation; 5 years of similar size & scope projects.
  3. Manufacturer Field Service Technician:
    - a. Manufacturer training certification.
    - b. NICET certification.
- B. Product Data:
1. Manufacturer data for each type of product, equipment, device, etc. proposed.
  2. For devices, include milliamp (mA) draw and listed minimum voltage required to operate for each type of device.
  3. For panels and power supplies, include voltage drop allowed for the panel and power supplies.
  4. For panels and power supplies, include voltage drop for individual Notification Appliance Circuits (NAC).
- C. Shop Drawings: For fire-alarm system to demonstrate compliance with project drawings and specifications. Include plans, elevations, sections, details, and attachments to other work.
1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
  2. Provide floor plans with:
    - a. Final equipment and device locations, including address of each addressable device and notification appliance.
  3. Provide voltage drop calculations for notification appliance circuits. Voltage drop at EOL device shall not exceed 14% of the battery voltage. Worst case voltage at each notification appliance shall be no less than the minimum listed operating voltage.
  4. Provide battery calculations.

5. System Response Matrix: Indicate fire alarm system's actions (outputs) required for each type of alarm, supervisory, and trouble signal.
- D. Installation Instructions: Manufacturer's detailed installation instructions for Fire Alarm Control Unit, duct mounted smoke detectors, flow switches, tamper switches, supervisory switches, and similar items which require mechanical installation.
- E. Sample Warranty Statement.
- F. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
  1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
  2. Provide "System Record of Completion" document with "Completion Documents" Article in "Documentation" chapter in NFPA 72.
  3. System Status and Programming Report.
  4. Record copy of site-specific software on USB flash drive (thumb drive).
  5. As-built documents.
    - a. Provide duplicates of the shop drawing plans, wiring diagrams, and riser diagrams showing comprehensive and clear field revisions. Include loop numbers, device addresses, terminal numbers where connected to equipment, and wire color codes.
    - b. Provide a drawing with submitted battery and voltage drop calculations. Include a field for entering actual metered values during system testing.
  6. Technical literature for all control equipment, devices, isolation modules, relays, power supplies, alarm/supervisory signal initiating devices, etc. Include maintenance data and parts lists. Include circuit diagrams of all control panels, modules, annunciators, communications panels, etc.
  7. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
    - a. Frequency of testing of installed components.
    - b. Frequency of inspection of installed components.
    - c. Requirements and recommendations related to results of maintenance.
    - d. Manufacturer's user training manuals.
  8. Manufacturer's required maintenance related to system warranty requirements.
  9. Abbreviated operating instructions, framed and mounted at fire-alarm control unit.
  10. Copy of NFPA 25.

## **1.8 SOFTWARE SERVICE AGREEMENT**

- A. Comply with UL 864.
- B. Technical Support: Beginning with Final Acceptance, provide software support for one year.
- C. Upgrade Service:
  1. Update software to latest version at Project completion.
  2. The manufacturer and authorized distributor of the system installed shall maintain software records on the system installed.
  3. At no charge, install and program software upgrades that become available within one year from date of Final Acceptance and for the life of the warranty period. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
  4. For new software versions that correct operating problems or bugs, free upgrades shall be provided during the life of the system.
  5. Provide 30 days notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

## **1.9 EXTRA MATERIALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Manual Fire Alarm Boxes: 1 unit of each type.
  - 2. Addressable Control Relays: 2 units of each type.
  - 3. Indoors Horn/Strobes: 2 units of each type.
  - 4. Indoor Strobes: 2 unit sof each type.
  - 5. Monitor Modules (Addressable Interface): 1 unit of each type.
  - 6. Smoke Detectors: 1 unit of each type.
  - 7. Detector Bases1 unit of each type.
  - 8. Lamps for Remote Indicating Lamp Units2 units.
  - 9. Keys and Tools: Three extra sets for access to locked and tamper-proofed components.
  - 10. Fuses: Two of each type and rating installed in the system.
  - 11. Interconnection cable, where required, for connecting the FACU to a personal computer.

## **1.10 WARRANTY**

- A. Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail because of defects in materials or workmanship within one year from the date of final inspection and acceptance by the Owner.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Fire Lite Alarms.
  - 2. Edwards.
  - 3. Notifier.
  - 4. Siemens Building Technologies, Inc.; Fire Safety Division.
  - 5. Silent Knight.

### **2.2 SYSTEMS OPERATIONAL DESCRIPTION**

- A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
  - 1. Manual stations.
  - 2. Smoke detectors.
  - 3. Duct smoke detectors.
  - 4. Automatic sprinkler system water flow.
- B. Fire-alarm signal shall initiate the following actions:
  - 1. Record events in the system memory.
  - 2. Continuously operate alarm notification appliances until initiating device and control unit have been reset.
  - 3. Identify alarm at fire-alarm control unit and remote annunciators with flashing LED, audible piezo-electric signal, and LCD display of alarm point and location.
  - 4. Transmit alarm signal to the remote alarm receiving station.
  - 5. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode. Typically, shutdown of all HVAC equipment will be initiated.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
  - 1. Fire alarm control unit has lost communication with network.
  - 2. Emergency Responder Radio Communications System monitored points.
  - 3. Valve supervisory switch.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
  - 1. Open circuits, shorts, and grounds in designated circuits.
  - 2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.

3. Loss of communication with addressable sensor, input module, relay, control module, remote annunciator.
  4. Ground or a single break in fire-alarm control unit internal circuits.
  5. Break in standby battery circuitry.
  6. Failure of battery charging.
  7. Abnormal position of any switch at fire-alarm control unit or annunciator.
  8. Loss of primary power or abnormal ac voltage at fire-alarm control unit.
  9. HVAC bypass defeat switch in bypass position.
- E. System Trouble and Supervisory Signal Actions:
1. Identify specific device initiating event at fire-alarm control unit and remote annunciators.
  2. Provide adjustable time delay capability of 0 to 60 minutes to delay transmission of the trouble and supervisory signals. The delay for loss of primary power or abnormal ac voltage shall be 1 to 3 hours.

### **2.3 FIRE-ALARM CONTROL UNIT**

- A. General Requirements for Fire-Alarm Control Unit (FACU):
1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
    - a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
    - b. Include a real-time clock for time annotation of events on the event recorder. Time of day and date shall be retained upon loss of system primary and secondary power.
    - c. The system shall have multiple access levels for Owner authorized personnel to disable individual alarm inputs or normal system responses for alarms, without changing the system's programming.
    - d. Programming and editing of the existing program shall be possible without special equipment and without interrupting alarm monitoring functions.
  2. Enclosure:
    - a. 3rd party listed cabinet suitable for surface, flush, or semi-flush mounting.
    - b. Finish: Rust resistant primer and manufacturer standard finish.
    - c. Door hinged on either right or left side (field selectable).
    - d. Door with key lock and glass opening for viewing all indicators.
    - e. Manufacturer's trim kit for flush or semi-flush mounting.
  3. Addressable initiation devices that communicate device identity and status (normal, trouble, and alarm conditions).
    - a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
    - b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
    - c. Alarm Verification: The system shall provide, as a feature, an alternate signal processing algorithm to verify the presence of smoke. The algorithm shall be selectable when programming. The total effective delay created by the algorithm shall not exceed 60 seconds.
  4. Addressable control circuits for shutdown of mechanical equipment.
  5. Signaling Line Circuits (SLC) Interface Boards:
    - a. Integral microprocessor with capability of operating locally in the event of FACU main microprocessor.
    - b. Provides power and communication with devices on SLC circuit loop.
    - c. Receives and processes analog information from all detectors with software to automatically maintain detectors' desired sensitivity levels
    - d. Automatic detector testing and determination of detector maintenance requirements.

6. The system shall retain historical data and device parameters including device sensitivity measurement testing results. The system shall have the capability to display and print device data, parameters, and sensitivity test results. Trouble indication shall be initiated when any smoke detector approaches 80% of its alarm threshold due to gradual contamination.
- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: Liquid-crystal type, backlit, 80 characters, minimum.
  2. Individual, color-coded system status LEDs for AC POWER, SYSTEM ALARM, SYSTEM TROUBLE, and SIGNAL SILENCE.
  3. Keypad: Alphanumeric; arranged to permit entry and execution of field programming, display, and control commands.
  4. Operator interface functions:
    - a. Acknowledge Switch.
    - b. Alarm Silence Switch with a Subsequent Alarm resound feature.
    - c. System Reset Switch.
    - d. System Test Switch.
    - e. Lamp Test Switch.
- C. Circuits:
1. Notification Appliance Circuits (NAC):
    - a. NFPA 72 Class B.
    - b. End of line (EOL) resistors shall be installed for FACU supervision of circuit integrity. Locate EOL resistors as follows:
      - 1) Where accessible to fire alarm system maintenance personnel.
      - 2) Where maintenance or testing at the EOL resistor location will not be disruptive to the normal use of the facility.
      - 3) Where not easily accessible to the normal building occupants.
      - 4) Where no higher than 9' AFF or lower than 7' AFF.
      - 5) Not in stairwells or restrooms.
    - c. NAC circuits shall not exceed 75% of maximum load current allowed.
  2. Signaling Line Circuits (SLC): NFPA 72 Class A, no "T" taps.
  3. Initiating Device Circuits (IDC): NFPA 72 Class B.
  4. Digital electronic signals shall utilize check digits or multiple polling to prevent a single ground or open on any SLC from causing system malfunction, loss of operating power, or the ability to report an alarm.
  5. Isolation Modules:
    - a. Isolation modules shall automatically isolate wire-to-wire shorts on an SLC circuit.
    - b. Install isolation modules at the following locations:
      - 1) In or adjacent to the FACU at each end of addressable loops.
      - 2) After each 20 initiating devices and control points on an addressable loop.
      - 3) For addressable loops with less than 20 devices and control points, install isolators at the middle of the loop in addition to those at the FACU.
      - 4) At the point where an addressable loop extends outside of the building.
    - c. Isolation modules shall be readily accessible, not located above ceilings, and clearly labeled. Record drawings shall indicate isolator module locations.
    - d. Provide an LED that flashes to indicate the isolation module is operational and that burns steady to indicate that a short circuit condition has been detected and isolated.
  6. Serial Interfaces: One RS-232 ports.
  7. Wiring Methods:

- a. All fire alarm circuitry shall be in  $\frac{3}{4}$ " minimum metal conduit. Junction boxes and covers not in finished areas shall be painted red. PVC conduit may be used underground, in concrete, or in locations subject to severe corrosion.
    - 1) Where installed in areas where exposed with no continuous suspended ceiling, support conduits high on roof support structure to minimize visibility from the floor level.
  - b. SLC addressable loop circuits shall be wired with type FPL/FLLR/FPLP fire alarm cable, 18 AWG minimum, low capacitance, copper, twisted pair. Cable jacket shall have a red jacket with red and black conductor insulation. For underground circuits, use type TC or PLTC cable (PE insulated).
  - c. All other circuits shall be wired with 14 AWG minimum, stranded copper, type THHN/THWN conductors. Color codes follow:
    - 1) Initiating Circuits, General: Red(+) / White(-).
    - 2) Initiating Circuits, Smoke Only: Violet(+) / Gray(-).
    - 3) Notification Appliance / alarm initiating circuits: Blue(+) / Black(-).
    - 4) AHU Shutdown Circuits: Yellow(+) / Brown(-).
  - d. Conduits that penetrate exterior walls shall be sealed with non-hardening electrical putty to prevent condensation infiltration.
  - e. Splices are allowed only at device terminals or on terminal blocks in cabinets.
  - f. Terminal block screws shall have pressure wire connectors of the self-lifting or box lug type.
  - g. Permanent wire markers shall be used to label connections at the FACU, other control equipment, power supplies, and in terminal cabinets.
  - h. Branch circuit breakers supplying 120 VAC to system equipment shall be physically protected with a breaker handle lock and identified with a  $\frac{1}{4}$ " permanent red dot applied to the breaker handle or exposed body area. The red identification shall not damage the overcurrent protective devices or obscure the manufacturer's markings.
- D. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory.
- E. AHU Shutdown Defeat Toggle Switch: A supervised toggle switch shall be provided in/adjacent to the Fire Alarm Control Unit, or as a key operated function in a Remote Annunciator. If installed at the Remote Annunciator, provide an engraved label at the FACU with AHU Shutdown Defeat Switch location. When placed in the Shutdown Defeat position, a system "trouble" signal shall be initiated.
- F. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- G. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.
- 1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
  - 2. 120V power supply entry point to the FACU enclosure shall be where designated by the manufacturer.
  - 3. 120V branch breaker shall be physically protected with a handle lock and identified with a  $\frac{1}{4}$ " diameter permanent red dot applied to the breaker handle or exposed body area.
- H. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
- 1. Batteries:
    - a. Gel-cell, sealed, plate nickel cadmium, maintenance free.

- b. Minimum of 24 hours standby capacity plus:
      - 1) 5 minutes of horn/strobe full alarm load.
  - 2. Charger: Dual-rate charging techniques for fast battery recharge.
- I. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

## **2.4 MANUAL FIRE-ALARM BOXES**

- A. General Requirements for Manual Fire-Alarm Boxes:
  - 1. Comply with UL 38.
  - 2. Dual-action mechanism, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
  - 3. Positive, visual indication of operation.
  - 4. Station Test and Reset: Key-operated switch.
  - 5. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
  - 6. Pull Station Cover with Horn: Provide cover for all manual pull stations.
    - a. Clear, tamperproof, polycarbonate cover hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
    - b. Listed for outdoor use for outdoor pull stations.
    - c. Flush mount cover for recessed boxes. Surface mount cover with conduit spacer for applications requiring surface mounted conduit.

## **2.5 SMOKE DETECTORS**

- A. General Requirements for System Smoke Detectors:
  - 1. Comply with UL 268; operating at 24-V dc, nominal.
  - 2. Detectors shall typically be two-wire type for connection to an SLC. Four-wire type detectors may be required if connecting to an existing four-wire system.
  - 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
  - 4. Integral Visual-Indicating Lights: Provide both alarm and power LEDs, flashing under normal conditions. LEDs shall burn steady, controlled by the FACU, to indicate an alarm condition.
  - 5. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring. Provide terminals in the fixed base for connection of a remote alarm LED.
  - 6. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
  - 7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
  - 8. Test Means: Provide a means to simulate an alarm condition and report to the FACU. Test shall be initiated at the detector (activation of a magnetic switch) or initiated remotely on command from the FACU when in "test" condition.
- B. Photoelectric Smoke Detectors:
  - 1. Use photoelectric / light scattering principal to measure smoke density and send data to the FACU representing analog level of smoke density.

2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
  - a. Primary status.
  - b. Device type.
  - c. Present average value.
  - d. Present sensitivity selected.
  - e. Sensor range (normal, dirty, etc.).
- C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
  1. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
    - a. Primary status.
    - b. Device type.
    - c. Present average value.
    - d. Present sensitivity selected.
    - e. Sensor range (normal, dirty, etc.).
  2. Each sensor shall have multiple levels of detection sensitivity.
  3. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied. Extend the full width of the duct and provide end support for those over 36" long.
  4. Provide a Remote Alarm Indicating Light (RAIL) with test switch for each duct detector, installed in the nearest corridor or public area.
  5. Provide a hinged duct access panel, 12"x12" minimum, for sampling tube inspection and cleaning.
  6. Weatherproof Duct Housing Enclosure: Where installed outside or in damp or wet locations, provide NEMA 250, Type 4X; NRTL listed for use with the supplied detector.

## 2.6 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, equipped for mounting as indicated and with screw terminals for system connections.
  1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections. Comply with requirements for both visual and audible notification appliances.
- B. Visible Notification Appliances (Strobes):
  1. Xenon strobe lights complying with UL 1971, 24-V dc nominal.
  2. Rated Light Output: 15/30/75/110 cd, selectable in the field.
  3. Flashing shall be in a temporal pattern, synchronized with other units. Maximum pulse duration: 0.2 seconds.
  4. Clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" shall be engraved in minimum 1-inch high letters on the lens.
  5. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
  6. Strobe Leads: Factory connected to screw terminals.
  7. Mounting Faceplate: Factory finished, red.
- C. Audible Notification Appliances (Horns / Sounders):
  1. Electric-vibrating-polarized type, 24-V dc nominal; with provision for housing the operating mechanism behind a grille.
  2. Provide an ANSI S3.41 three-pulse temporal pattern audible signal, synchronized.
  3. Horns shall produce a sound-pressure level of 90 dB, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol. Output sound level shall be 120 dB maximum.
  4. Devices located outdoors shall be listed for use in wet locations.
  5. Field programmable without the use of special tools.

- D. Bells: 10" diameter vibrating type, 24V dc nominal. Bells located outdoors shall be listed for use in wet locations.

## **2.7 ADDRESSABLE INTERFACE DEVICES**

- A. Monitor Modules:
  - 1. For use in providing a system address for alarm-initiating devices for wired applications with normally open dry contacts.
  - 2. Provide an LED that flashes under normal conditions, indicating that the monitor module is operational and in regular communication with the FACU.
  - 3. Modules installed in non-conditioned spaces shall be tested, listed, and marked for continuous duty across the range of temperatures and humidity expected at their installed locations.
- B. Control Modules:
  - 1. For use in auxiliary control functions, operating as a dry contact relay.
  - 2. Typical equipment control functions would include direct signals to: an elevator controller to initiate elevator recall, to a circuit-breaker shunt trip for power shutdown, or to a lighting control system for lighting control scenario under fire alarm conditions.
  - 3. For use in supervising and controlling the operation of one NAC.
  - 4. Provide an LED that flashes under normal conditions, indicating that the monitor module is operational and in regular communication with the FACU.

## **2.8 REMOTE ANNUNCIATOR / INDICATOR LIGHTS (RAIL)**

- A. Provide 24V dc RAILS with an associated key-type switch for testing of the annunciated device.

## **2.9 AUXILIARY POWER SUPPLIES**

- A. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module.
  - 1. Alarm current draw of entire supplied circuitry loads shall not exceed 80 percent of the power-supply module rating.
  - 2. 120V branch breaker shall be physically protected with a handle lock and identified with a ¼" diameter permanent red dot applied to the breaker handle or exposed body area.
- B. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
  - 1. Batteries:
    - a. Gel-cell, sealed, plate nickel cadmium, maintenance free.
    - b. Minimum of 24 hours standby capacity plus:
      - 1) 5 minutes of horn/strobe full alarm load.
    - c. Add battery capacity for a 25% safety factor.
  - 2. Charger: Dual-rate charging techniques for fast battery recharge.
  - 3. Battery cabinet enclosures shall be twice the size of the batteries contained.
- C. Auxiliary power supplies shall be individually monitored by the FACU and protected by a smoke detector.

## **2.10 ALARM COMMUNICATOR TRANSMITTER**

- A. Dual path alarm communicator transmitter shall be compatible with and acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
- B. Functional Performance:
  - 1. Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically transmit signals to a remote supervising station.
  - 2. If communications is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote supervising station over the alternate communications path.
  - 3. Transmitter shall automatically report communications to the remote supervising station. If service is lost on communications paths, transmitter shall initiate the local trouble signal.

4. Precedence of signals transmitted to the remote supervising station shall be: (1) Fire Alarm, (2) Supervisory Signal, (3) Trouble Signal, (4) Security Alarm.
- C. Digital data transmission shall include the following:
1. Address of the alarm-initiating device.
  2. Address of the supervisory signal.
  3. Address of the trouble-initiating device.
  4. Loss of ac supply or loss of power.
  5. Low battery.
  6. Abnormal test signal.
  7. Communication bus failure.
- D. Secondary Power: Integral rechargeable battery and automatic charger.
- E. Self-Test: Conducted automatically every 24 hours with report transmitted to remote supervising station.

## **2.11 SURGE PROTECTION**

- A. AC Input:
1. Mount in listed enclosure adjacent to branch circuit panelboard. Wind small coil (5 to 10 turns) in branch circuit conductor just downstream of the suppressor connection.
  2. Install feed through branch circuit transient suppressor (Ditek #DTK-120SRD, Leviton #51020-WM/DIN, or approved equivalent that is UL 1449 2nd Edition Listed).
- B. DC Circuits Extending Outside Building:
1. Mount inside the building, near the point of entry to or exit from each building in a labeled enclosure.
  2. Provide "pi"-type filter on each conductor, consisting of primary arrestor, series impedance, and fast-acting secondary arrestor that clamps at 30-40V.
  3. A minimum of 36" of conductor length shall be provided between the "pi"-type filter and the first system device in the building.
  4. Acceptable models: Citel America #B280-24VD3, Ditek #DTK-2MHLP24BWB, Simplex #2081-9027/9028.

## **2.12 WATER FLOW SWITCHES**

- A. Flow switches shall be integral, mechanical, non-coded, non-accumulative retard type.
- B. Flow switches shall have an alarm transmission delay that is adjustable from 0 to 60 seconds. Initial settings shall be 30 to 45 seconds.
- C. Flow switches shall be located a minimum of one foot from any fitting that changes the direction of flow and a minimum of 3 feet from a valve, as required by NFPA 13.
- D. Flow switches shall be furnished and installed by the Mechanical/Sprinkler Contractor. The Electrical/Fire Alarm Contractor shall make electrical connections.

## **2.13 VALVE SUPERVISORY SWITCHES**

- A. Supervisory switch mechanisms shall be contained in weatherproof housings with  $\frac{3}{4}$ " tapped conduit entrance fittings and hardware for attachment to the valves. Switch housings shall be finished in red, baked enamel paint.
- B. Mount switches to not interfere with normal operation of the valves. Adjust switches to operate within two revolutions toward the closed position of the valve control, or when the stem of the valve has moved no more than one-fifth of the distance from its normal position.

## **2.14 REMOTE ANNUNCIATOR**

- A. Description: Annunciator functions utilizing an alphanumeric display and LED indicating lights shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual control functions shall match those of fire-alarm control unit; including acknowledge, silence, reset, and test for alarm supervisory, and trouble signals.
1. Mounting: Flush cabinet, NEMA 250, Type 1.

2. Alarm signal with alarm resound feature.
3. Communication via two-wire EIA-485 interface.
4. The fire alarm system shall be capable of supporting a minimum of four remote annunciators.

## **2.15 SNAP EDGE FRAMES**

- A. Description: Mountable Front Load Easy Open Snap Frame
  1. Outside edges flip open for quick document changes.
  2. Non-glare plastic cover.
  3. Design Basis: U-Line #S-2132 Series.
  4. For use with operator's instructions and device map.

## **PART 3 - EXECUTION**

### **3.1 EQUIPMENT INSTALLATION**

- A. Comply with NFPA 72 for installation of fire-alarm equipment.
- B. Equipment and Device Mounting:
  1. Install fire-alarm control unit with tops of cabinets not more than 72 inches above the finished floor.
  2. Install equipment and devices securely attached to walls, ceilings, floors, building structure. Hardware and supports shall be suitable for the load supported. Ceiling mounted devices shall not be supported solely by suspended ceilings.
- C. Smoke- or Heat-Detector Spacing:
  1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
  2. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.
  3. When installed in a room, orient so that the alarm LED is visible from the nearest door to the corridor.
- D. Duct Smoke Detectors:
  1. Comply with NFPA 72 and NFPA 90A.
  2. Install sampling tubes so they extend the full width of duct, and install detectors and sampling tubes in a manner that provides convenient access for periodic cleaning and calibration. Sampling tubes over 36" long shall be supported at both ends.
  3. Each installation shall have a hinged or latched duct access panel (12"x12" minimum) for sampling tube inspection and cleaning. Provide a permanent decal on duct indicating air flow direction.
  4. Each duct detector shall have a RAIL installed in the nearest corridor or public area, identified with an engraved label affixed to the wall or ceiling.
  5. Proper installation of duct detectors and access doors shall be coordinated between the Electrical Contractor subcontractor, Mechanical Contractor subcontractor, Fire Alarm subcontractor, and approved by the Engineer prior to equipment installation.
- E. Detector Protection:
  1. Unless suitably protected from dust, paint, etc.; detectors shall not be installed until final construction clean-up is complete. If contaminated, detectors shall be replaced.
- F. Audible Alarm-Indicating Devices: Unless ceiling mounted, install not less than 6 inches below the ceiling. Install horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- G. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn; and unless ceiling mounted, install at least 6 inches below the ceiling.
- H. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- I. Annunciator: Install with top of panel not more than 72 inches above the finished floor.
- J. Control Selector Switches:

1. Toggle switches with LED status indicator lights.
2. Hand in "up" position with amber LED. Auto in "center" position with green LED. Off in "down" position with red LED.

### **3.2 CONNECTIONS**

1. Rolling steel fire doors shall automatically reset when returned to their normal / raised position. Program the fire alarm system to limit which initiation devices release these doors; typically, the smoke detector and/or waterflow alarms in adjacent spaces. Label the FACU appropriately with an information placard regarding rolling steel fire door operation.
- B. Make addressable connections with a supervised interface device to the devices and systems indicated on the drawings. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
- C. Sprinkler system supervisory circuits for monitoring flow, valve position, water temperature, etc. shall initiate distinct audible and visual indications at the FACU. The audible signal shall either be a 4" diameter bell or a pulsing piezo-electric alarm. Provide an engraved label adjacent to the bell/alarm indicating "SPRINKLER STATUS ABNORMAL". If only sprinkler valve position is supervised, engraved label shall indicate "SPRINKLER VALVE CLOSED".

### **3.3 REMOTE ALARM TRANSMISSION**

- A. The Contractor shall program the alarm communicator transmitter, connect communication lines, coordinate signal transmission with the supervising station, and verify proper signal receipt by the supervising station.

### **3.4 IDENTIFICATION**

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section "Electrical Identification."
- B. Detectors, appliances, and modules shall be labeled with unique numbers that are indicated on as-built drawings and permanently mounted on device bases. Labels shall be legible from floor level. Detectors shall be labeled uniquely and sequentially starting at the FACU with both SLC and device designations. Labels shall be printed black lettering on clear background and attached to the device base.
- C. Junction and pull box covers shall be labeled to indicate the circuits or function of the conductors contained in the boxes. Labels shall be neatly applied with black lettering on clear background.
- D. Conductors shall be labeled with permanent wire markers at connections at the FACU, other control equipment, power supplies, and terminal cabinets.
- E. Install framed basic operating instructions in a location visible from fire-alarm control unit. Optionally, with Owner concurrence, the instructions may be affixed to the inside of the FACU door.
- F. Floor plans of the fire alarm system installation shall be provided at the FACU.
- G. Install a lockable document cabinet adjacent to the FACU. Key shall match the FACU lock. Label Fire Alarm System Record Documents. Store the following:
  1. As-built record drawings with floor plans of the fire alarm system installation.
    - a. Floor plans shall include device locations and addresses. Indicate equipment, module, and EOL locations.
    - b. Provide a legend for symbols used.
    - c. A separate page shall be provided for each floor. Laminate individual pages and bind all pages in a book form.
  2. NFPA 72 Record of Completion documentation.
  3. Records of system inspections, testing, and maintenance documentation.
  4. System calculations.

- 5. System operational matrix.
- H. At all equipment with a 120 VAC power source, provide an engraved label indicating panelboard ID, branch circuit number, and panelboard location. At the FACU, provide an additional engraved label inside the FACU.

### **3.5 GROUNDING**

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

### **3.6 FIELD QUALITY CONTROL**

- A. Programming revisions shall be made only by the Installer.
- B. Final field tests shall be witnessed by authorities having jurisdiction.
- C. Manufacturer's Field Service: Engage a factory-authorized service technician to make connections to the FACU; to program the system; to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- D. Tests and Inspections:
  - 1. Visual Inspection: Conduct visual inspection prior to testing.
    - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
    - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
  - 2. Conductor Testing: All conductors shall be tested for grounds, opens and shorts prior to termination at panels and installation of detector heads. Conductors shall be megger tested for a minimum of 10 megohms from conductor to ground and conductor to conductor. Provide record of test results to Engineer in advance of acceptance inspection.
  - 3. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
  - 4. Test 100% of alarm initiating devices, all software functions, all other system functions including alarm communicator transmitter communication, and verify system operational matrix. Notify Architect 2 weeks in advance of this test to permit witness observation.
  - 5. Print a System Status and Programming Report with settings for each alarm indicating device, the current sensitivity of each analog addressable smoke detector, and detailed system operational matrix.
  - 6. Factory-authorized service representative shall prepare the NFPA 72 "Fire Alarm System Record of Completion" form. Submit "Fire Alarm System Record of Completion" form to Engineer for delivery to Owner.
  - 7. After 100% system test and submission of "Fire Alarm System Record of Completion" form, schedule an AHJ acceptance inspection, a minimum of 2 days after completion of system testing.
  - 8. For AHJ acceptance inspection, perform sampling testing as directed by AHJ for detectors and functional tests. Provide 2-way radios, ladders, smoke source, and other materials needed for testing the system.
- E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- F. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.

### **3.7 TRAINING / DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel for a minimum of 4 hours to adjust, operate, and maintain fire-alarm system. Training schedule must be coordinated to meet the Owner's schedule. Training location will be provided by the Owner.
- B. As a minimum, training shall cover:
  - 1. System software multiple access levels via password protection for accommodating Owner capability for disabling individual alarm inputs or normal outputs for alarms without modifying the system programming or affecting operation of the remainder of the system.
  - 2. Overall system concepts, capabilities, and functions. Training shall be of sufficient detail so that the Owner shall be able to remove any device from service and return to service without the need for the Manufacturer's approval or assistance.
  - 3. Methods and means of troubleshooting and replacement of all field wiring devices.
  - 4. Methods and means of troubleshooting the main FACU and field devices for programming, bussing systems, internal panel and unit wiring, circuitry, and interconnections.
  - 5. Preventative maintenance service techniques and schedules, including historical data trending of alarm and trouble records.
  - 6. Training documentation and actual system software used for training shall be provided in digital form and left with the Owner at the completion of training.
- C. Provide two bound copies of training information.

**END OF SECTION**

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## **SECTION 28 5000**

### **EMERGENCY RESPONDER COMMUNICATION COVERAGE SYSTEM**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. In-building radio signal amplification system.
  - 2. A system shall be provided to cover new building.
- B. Related Sections include the following:
  - 1. Section "Basic Electrical Materials and Methods" for supports, anchors, and identification products.
  - 2. Section "Conductors and Cables" for power supply circuitry.
  - 3. Section "Grounding and Bonding".
  - 4. Section "Raceways and Boxes".

##### **1.3 DEFINITIONS**

- A. AHJ: Authority Having Jurisdiction
- B. BDA: Bi-Directional Amplifier: Device used to amplify band-selective or multi-band RF signals in the uplink, to the base station and in the downlink from the base station to subscriber devices for enhanced signals and improved coverage
- C. DAS: Distributed Antenna System
- D. FCC: Federal Communications Commission
- E. RF: Radio Frequency

##### **1.4 ACTION SUBMITTALS**

- A. RF Surveys / Shop Drawings: Measurement drawings of each floor of the building which indicate relative RF field strength for each frequency and band of interest. Submit to both the AHJ and the Engineer.
  - 1. Initial signal strength mapping.
  - 2. Pre-final signal strength mapping.
- B. Shop Drawings:
  - 1. Include plans and details for code compliant, UL Listed, DAS system design for emergency responder radio coverage.
- C. Product Data:
  - 1. Include bill of materials for all BDA / DAS equipment and components.
  - 2. Manufacturer product data sheets and cut sheets for all equipment and components.

##### **1.5 INFORMATIONAL SUBMITTALS**

- A. Sample Warranty: Manufacturer's standard warranty.

##### **1.6 CLOSEOUT SUBMITTALS**

- A. RF Survey / Shop Drawings: Final installed measurement drawings of each floor of the building which indicate relative RF field strength for each frequency and band of interest.
- B. Operation and Maintenance Data: For all system equipment and components to include in emergency, operation, and maintenance manuals.

### **1.7 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

### **1.8 WARRANTY**

- A. Special Warranty: Manufacturer agrees to repair or replace components that fail in materials or workmanship within a specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Provide an in-building radio signal amplification system to provide complete coverage in the building for the public safety agencies. System shall meet the requirements of:
  - 1. The local AHJ.
  - 2. FCC.
  - 3. The North Carolina Fire Code.
  - 4. NFPA 72, National Fire Alarm and Signaling Code.
    - a. In accordance with NFPA 72, emergency responder radio coverage systems must be designed, installed, and maintained in accordance with NFPA 1221, Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems.
  - 5. UL 2524, Standard for In-building 2-Way Emergency Radio Communication Enhancement Systems.
- B. All system coaxial cables shall be plenum rated.
- C. Donor antenna cable and riser coaxial cables shall be rated as riser cables and routed through 2-hour-rated enclosures.
- D. Connections between riser coaxial cables and horizontal coax cables to system antennas shall be made within 2-hour-rated enclosures.

## **PART 3 - EXECUTION**

### **3.1 RF FIELD SURVEYS**

- A. Perform initial signal strength mapping on-site field surveys to determine if a system is required due to inadequate radio signal coverage.
- B. Perform pre-final signal strength mapping on-site field surveys for a final determination of whether or not a system is required. If a system is required, signal strength mapping performed should serve to provide data suitable to prepare system designs.

### **3.2 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.

### **3.3 INSTALLATION**

- A. Install system equipment and components.
- B. Coordinate infrastructure needs for system installation.
- C. Grounding:
  - 1. Ground and bond coax cable shield and associated metallic conduits.
  - 2. Ground and bond coax cable surge suppressor and associated metallic conduits.

### **3.4 IDENTIFICATION**

- A. Identify and mark equipment and components with engraved labels as specified in Section "Electrical Identification".

### **3.5 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to:
  - 1. Test and adjust equipment and components.
  - 2. Perform startup and commissioning of system.
- B. Tests and Inspections:
  - 1. Perform final testing for the local inspection authority, including final signal strength mapping.
  - 2. Perform final testing and demonstration with the AHJ.
  - 3. Submit final signal strength mapping results shop drawings.

**END OF SECTION**

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**SECTION 31 10 00  
SITE CLEARING**

**PART 1 - GENERAL**

**1.1 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. Standards set forth by the North Carolina Department of Environmental Quality (NCDEQ) Division of Energy, Mineral and Land Resources.

**1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Removal of trees and other vegetation.
  - 2. Clearing and grubbing.
  - 3. Removing above-grade improvements.
  - 4. Removing below-grade improvements.
- B. Related Sections:
  - 1. Division 31 Section "Earth Moving".
  - 2. Division 31 Section "Erosion Controls".

**1.3 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 improvements on adjoining properties and on Owner's property.
  - 2. Restore damaged improvements to their original condition, as acceptable to property owners.
  - 3. All erosion control measures shall be in place prior to commencement of clearing operations.
- C. Protection of Existing Trees and Vegetation: 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. Provide temporary guards to protect trees and vegetation to be left standing.
  - 1. Water trees and other vegetation to remain within limits of contract work as required to maintain their health during course of construction operations.
  - 2. Provide protection for roots over 1-1/2 inch (38 mm) in diameter that are cut during construction operations. Coat cut faces with an emulsified asphalt or other acceptable coating formulated to 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.
  - 3. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations in a manner acceptable to Engineer. Employ a licensed arborist to repair damage to trees and shrubs.
  - 4. Replace trees that cannot be repaired and restored to full-growth status, as determined by arborist.
- D. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated or directed.

**1.4 EXISTING SERVICES**

- A. General: Indicated locations are approximate; determine exact locations before commencing Work.

- B. Arrange and pay for disconnecting, removing, capping, and plugging utility services. Notify affected utility companies in advance and obtain approval before starting this Work.
- C. Place markers to indicate location of disconnected services. Identify service lines and capping locations on Project Record Documents.

#### 1.5 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

#### PART 2 – PRODUCTS

None Used.

#### PART 3 – EXECUTION

##### 3.1 SITE CLEARING

- A. General: Remove trees, shrubs, grass, and other vegetation, improvements, or obstructions, as required, to permit installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated. Removal includes digging out and off-site removal of stumps and roots.
  - 1. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
  - 2. Existing trees within clearing limits may be chipped and stockpiled on-site but shall NOT be used as landscaping mulch or fill.
- B. Clearing and Grubbing: Clear site of trees, shrubs, and other vegetation, except for those indicated to be left standing.
  - 1. Completely remove stumps, roots, and other debris protruding through ground surface.
  - 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.
    - a. Place fill material in horizontal layers not exceeding 6 inches (150 mm) loose depth, and thoroughly compact each layer to a density equal to adjacent original ground.
- C. Topsoil Stripping: Strip and stockpile existing topsoil within construction limits for re-spreading. Should the Contractor elect to remove topsoil from the site, suitable topsoil from off-site sources shall be provided for re-spreading at no cost to the Owner.
  - 1. Remove sod and grass before stripping topsoil.
  - 2. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials. All surface topsoil, regardless of thickness encountered, shall not be considered Unsuitable Soil.
  - 3. Remove subsoil and non-soil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.
  - 4. Stockpile topsoil materials within construction limits and away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 5. Do not stockpile topsoil within tree protection zones.
  - 6. Dispose of excess topsoil off-site.
- D. Removal of Improvements: Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction.
  - 1. Abandonment or removal of certain underground pipe or conduits may be indicated on mechanical or electrical drawings and is included under work of related Division 22 Sections. Removing

abandoned underground piping or conduits interfering with construction is included under this section.

### 3.2 DEMOLITION PREPARATION

- A. 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 or as shown on the drawings.
- B. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around selective site demolition area.
  - 1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction or as shown on the plans.
  - 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 weather protection, during interval between demolition and removal of existing construction, on exterior surfaces and new construction to ensure that no water leakage or damage occurs to structure or interior areas.
- C. Provide and maintain exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of building to be selectively demolished.
  - 1. Strengthen or add new supports when required during progress of selective demolition.
- D. Protect trees, fences, poles, mailboxes, and all other property unless their removal is authorized. Any property damaged, that is not authorized for removal, shall be restored or replaced to the Owner's satisfaction.

### 3.3 UTILITY SERVICES

- A. Maintain existing utilities indicated to remain in service and protect them against damage during selective site demolition operations.
  - 1. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to governing authorities.
    - a. Provide not less than 72 hours' notice to Owner if shutdown of service is required during changeover.
- B. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services serving building to be selectively demolished.
  - 1. Arrange to shut off indicated utilities with utility companies.
  - 2. Where utility services are required to be removed, relocated, or abandoned, provide bypass connections to maintain continuity of service to other parts of the building before proceeding with selective demolition.
- C. Utility Requirements: Refer also to Division 21, 22, 23 and 26 Sections for additional requirements for shutting off, disconnecting, removing, and sealing or capping utility services. Do not start selective site demolition work until utility disconnecting and sealing have been completed and verified in writing.
- D. Utility Adjustments and Relocations: Adjust locations, elevations and routes of existing utility lines, poles, guys, vaults, handholes, boxes, and other related appurtenances as required to facilitate new construction. Coordinate adjustments and relocations with utility companies.

### 3.4 POLLUTION CONTROLS

- A. 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.
- B. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective site demolition operations. Return adjacent areas to condition existing before start of selective demolition.

### 3.5 SELECTIVE SITE DEMOLITION

- A. Demolish and remove existing construction only to the extent required by new construction and as indicated on the drawings. Completely demolish and remove existing improvements; including footings, utilities and other below-grade elements; as indicated on the drawings. Use methods required to complete Work within limitations of governing regulations.
  - 1. Dispose of demolished items and materials promptly. On-site storage or sale of removed items is prohibited.
  - 2. Return elements of construction and surfaces to remain to condition existing before start of selective demolition operations.
  - 3. Comply with all applicable regulations during demolition, handling and disposal of all items indicated to be removed or necessary to be removed to allow construction of new work.
- B. Demolish asphalt, concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain, using power-driven masonry saw or hand tools; do not use power-driven impact tools.
- C. Remove sawcut concrete and asphalt, including aggregate base, to a depth of 12-inches below existing, adjacent grade, or as indicated. Provide neat sawcut at limits of pavement removal as indicated.

### 3.6 PATCHING AND REPAIRS

- A. Promptly patch and repair holes and damaged surfaces caused to adjacent construction by selective site demolition operations.
- B. Where repairs to existing surfaces are required, match previous work as closely as possible.
  - 1. Completely fill holes and depressions in existing masonry walls to remain with an approved masonry patching material, applied according to manufacturer's printed recommendations.
- C. 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.

### 3.7 CLEANING

- A. Keep the site free from debris and hazards and inspect the site at the end of each day for trash. All adjacent roads and drives outside of the construction fencing shall remain in operation during construction and shall remain free of all construction materials and debris.

### 3.8 DISPOSAL OF WASTE MATERIALS

- A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. Burning on Owner's Property: Burning is not permitted on Owner's property.
- C. Removal from Owner's Property: Remove waste materials and unsuitable or excess soils and mulch from Owner's property. Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION

## SECTION 31 20 00 – EARTH MOVING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Report of Subsurface Investigation.
  - 1. The geotechnical report is available to bidders as general information with regard to project and site conditions. However, the geotechnical report is not a part of the contract documents and is not a warranty or guarantee of subsurface conditions. Variations in subsurface conditions should be anticipated. Bidders should carefully inspect the site prior to bidding and will be provided reasonable access to perform independent explorations of subsurface conditions, if requested.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Preparing and grading subgrades for walks, lawn areas, and landscaping.
  - 2. Excavating, filling and backfilling for structures.
  - 3. Base course for walks and pavements.
  - 4. Subsurface drainage backfill for trenches.
  - 5. Excavating and backfilling trenches.
- B. Related Sections: The following Sections contain requirements that relate to this Section.
  - 1. Division 01 Sections for allowances, definitions and procedures.
  - 2. Division 31 Section "Site Clearing" for site stripping, grubbing, topsoil removal, and tree protection.
  - 3. Division 33 Section "Storm Drainage Utilities" for storm drainage.
  - 4. Division 32 Section "Planting" for finish grading, including placing and preparing topsoil for permanent and temporary grass seeding.
  - 5. Division 31 "Erosion and Sediment Controls", for all areas of the site that are graded or disturbed by any construction operations

#### 1.3 UNIT PRICES

- A. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following:
  - 1. 24 inches outside of concrete forms other than at footings.
  - 2. 12 inches outside of concrete forms at footings.
  - 3. 6 inches outside of minimum required dimensions of concrete cast against grade.
  - 4. 6 inches beneath bottom of concrete slabs on grade.
  - 5. 6 inches beneath invert elevation of pipe in trenches and the greater of 24 inches wider than pipe outside diameter or 42 inches.
  - 6. Additional rock removed beyond the limits outlined above to accommodate trench boxes, other removal methods, compaction equipment or other reasons shall not be included in the payment volume.
  - 7. Any materials paid by Unit Prices to replace excavated rock shall utilize these same measurement limits.
- B. Unsuitable Soil Measurement: Volume of soil actually removed, measured in original position, but not to exceed the limits directed by the Owner's Independent Testing Agency.
  - 1. Additional soil excavated beyond the limits directed by the Owner's Independent Testing Agency; including lay-back of excavation walls, excavation to accommodate trench boxes or other shoring, etc.; shall not be considered Unsuitable Soil.
- C. Replacement Material Measurement: Volume exactly equal to that of the unsuitable soil or rock that was removed, measured in original position.

- D. Unit prices for Unsuitable Soil removal and Rock removal shall include all work and materials as defined in Division 01 sections.

#### 1.4 DEFINITIONS

- A. Excavation consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed. Refer to the following section for additional definitions of classified excavations.
- B. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below base course, drainage fill, or topsoil materials.
- C. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.
- D. Surface Course: The top layer of the pavement structure placed on base course or subgrade.
- E. Base Course: Layer placed between the subgrade elevation and asphalt paving courses.
- F. Bedding Course: Layer placed over excavated subgrade in a trench before laying pipe.
- G. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Architect. Unauthorized excavation, as well as remedial work directed by the Architect, shall be at the Contractor's expense.
- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.
- I. Structural Areas: Areas containing Structures and pavement and extending 10-ft beyond the limits of structures and pavements. Structural Areas in fill shall also include the area supporting the fill slope along a 1:1 slope to existing grade. Pavement areas include but are not limited to roads, driveways, parking lots, curbs, sidewalks, dumpster pads, equipment pads, concrete pads, tracks, tennis courts, and other similar above grade improvements.
- J. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

#### 1.5 EXCAVATION CLASSIFICATIONS

- A. Excavation Classifications: All excavation is classified as General Excavation except for Mass Rock, Trench Rock and Unsuitable Soil Materials as defined in this section.
  - 1. General Excavation: Excavation, removal and/or disposal of pavements and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and/or removed; together with soil, boulders, and other materials encountered that are not classified as rock, unsuitable soil, or unauthorized excavation.
    - a. Intermittent drilling, blasting, or ripping to increase production and not necessary to permit excavation of material encountered will be considered general excavation.
    - b. Soil (regardless of nature) or other debris encountered above proposed subgrade elevations shall be considered general excavation unless determined by the Architect to meet the definition of rock.
    - c. In-place densification by vibratory rolling of existing soils at exposed subgrades, as described herein, shall be considered General Excavation.
  - 2. Unsuitable Soil Excavation: Removal and disposal of soil materials or other debris encountered below proposed subgrade elevations which is deemed unsuitable to remain in place by the Architect or Owner's Independent Testing Agency.
    - a. Soil and/or other debris encountered above proposed subgrade elevations shall be considered general excavation.

- b. Soil material which, in the opinion of the Architect or Owner's independent testing agency, can be repaired by scarifying, drying and recompacting or material which is made unsuitable by delay of work, lack of protection or other actions of the Contractor or his Sub-Contractors shall not be considered as unsuitable soil and shall be repaired or replaced by the Contractor at no additional cost to the Owner. Moisture content alone shall not be the determining factor as to the presence of unsuitable soil.
  - c. Any material moved or removed without the measurement by the Owner's independent testing agency and approval by the Architect will be considered as general excavation.
  - d. Surface topsoil, regardless of thickness encountered, shall not be considered unsuitable soil.
  - e. Stones, rocks and boulders not meeting classifications of rock shall not be considered unsuitable soil. Stones, rocks and boulders shall be removed from soil as necessary if soil is to be used as fill or backfill. Removed stones, rocks and boulders shall be removed from the site.
  - f. The unsuitable soil allowances shall be for unsuitable soils only and not for repair of weather related deterioration of subgrade. These Allowances are not for required on-site cut and off-site fill necessary to bring subgrades and grades to elevations shown on drawings. Contractor shall be responsible for proper drying and dewatering procedures, as necessary, as part of his normal operations.
- 3. Mass rock Excavation: Removal, in Open Excavations, of rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1.5-cu.yd. that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted. In the event rock (as defined above) is encountered, the Contractor shall immediately notify the Architect.
  - a. Mass Rock Excavation Equipment: Late-model, track-type CAT D-8 crawler tractor operating at one mile per hour in the lowest available gear, and at the highest normal operating rpm pulling a sharp, single-toothed ripper. The Contractor shall provide equipment specification and test data verifying that the equipment to be used for demonstration purposes complies with the minimum requirements. The equipment shall be in good repair and in proper working condition. The Owner reserves the right to inspect and approve the equipment to be used for demonstration purposes. The Contractor shall demonstrate (at no additional cost) to the Architect or Owner's independent testing agency that the rock cannot be practically ripped with equipment equivalent that specified above without systematic drilling and blasting. Mass rock is defined as material which, after 1 hour of continuous ripping using the equipment described above, produces less than 30 cubic yards of removable material.
- 4. Trench Rock Excavation: Removal, in Trench Excavations, of rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1.0-cu.yd. that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted. In the event rock (as defined above) is encountered, the Contractor shall immediately notify the Architect.
  - a. Trench rock excavation equipment: Late-model, track mounted CAT 330 or equivalent hydraulic excavator equipped with a narrow (36" max) bucket with new rock teeth and operating at the highest normal operating RPM. The Contractor shall provide equipment specification and test data verifying that the equipment to be used for demonstration purposes complies with the minimum requirements. The equipment shall be in good repair and in proper working condition. The Owner reserves the right to inspect and approve the equipment to be used for demonstration purposes. Trench rock is defined as material which, after 1 hour of continuous digging using the equipment described above, removes less than 10 cubic yards of material.
- 5. Classified excavation requirements:
  - a. Excavations more than both 10 feet in width and more than 30 feet in length are defined as Open Excavations. Excavations less than both 30 feet in width and less than 30 feet in length are defined as Trench Excavations.

- b. Contractor shall expose and clean the rock material for inspection and measurement by the Architect.
- c. Do not excavate rock or unsuitable soil until it has been classified and cross-sectioned by the Owner's independent testing agency or Architect. Any material moved or removed without the measurement by the Owner's independent testing agency and approval by the Architect will be considered as General Excavation.
- d. The Architect shall be the final judge on what is classified as unsuitable or rock excavation.
- e. The contractor may be required to provide equipment specification data verifying that the above minimum-rated equipment will be used for demonstration purposes. The equipment shall be in good repair and in proper working condition.
- f. Rippable rock, weathered rock or overburden which is not classified as rock according to the above definitions shall be considered General Excavation.

#### 1.6 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Test Reports: In addition to test reports required under field quality control, submit the following:
  - 1. Laboratory analysis of each soil material proposed for fill and backfill from on-site and borrow sources.
  - 2. One optimum moisture-maximum density curve for each soil material.
  - 3. Reports of all laboratory and field tests including evaluations of subgrades and foundation bearing conditions.
  - 4. As-built survey of athletic fields, courts and tracks demonstrating compliance with specified tolerances.
  - 5. Reports of Special Inspections.
- C. Blasting plan approved by authorities having jurisdiction if applicable due to on-site rock.
- D. Report of rock or unsuitable soil removal with quantities confirmed in writing by the Architect or Owner's independent testing agency.

#### 1.7 QUALITY ASSURANCE

- A. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction. Any earthwork required for preparation of parking areas and drives shall comply with current NCDOT Standard Specifications as per the North Carolina Construction Manual.
- B. Comply with applicable requirements of NFPA 495--Explosive Materials Code.
- C. Testing and Inspection Service: Owner will employ a qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soils to verify that soils comply with specified requirements and to perform required field and laboratory testing.
- D. Special Inspections: Owner will employ a qualified Special Inspector or Special Inspection Agency to perform verification and inspection of earthwork construction in accordance with NC State Building Code.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1
  - 1. Before commencing earthwork, meet with representatives of the governing authorities, Owner, Architect, consultants, Geotechnical Engineer, independent testing agency, and other concerned entities. Review earthwork procedures and responsibilities including testing and inspection procedures and requirements. Notify participants at least 3 working days prior to convening conference. Record discussions and agreements and furnish a copy to each participant.

#### 1.8 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted in writing by the Architect and then only after acceptable temporary utility services have been provided.

1. Provide a minimum 48-hours' notice to the Architect and receive written notice to proceed before interrupting any utility.
  - B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shutoff services if lines are active.
- 1.9 PAYMENT
- A. General Excavation: All general excavation to the lines and grades indicated on the drawings including all necessary off-site disposal of excess materials and/or off-site borrow of fill materials shall be included in the base bid.
    1. No statement is made or implied that the on-site grading and earthwork indicated on the drawings is balanced.
  - B. Unsuitable Soil Material Excavation: Unsuitable soil material excavation will be paid by unit prices included in the Contract Documents.
    1. Unused amounts of monies included under allowances shall be credited to the Owner by deduct change order.
  - C. Rock Excavation: Mass rock and Trench rock excavation will be paid by unit prices included in the Contract Documents.
    1. Unused amounts of monies included under allowances shall be credited to the Owner by deduct change order.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. General: Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations.
- B. Satisfactory Soil Materials: ASTM D 2487 soil classification groups GW, GC, GP, GM, SW, SP, SC, and SM; free of rock or gravel larger than 2 inches (50 mm) in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter. Additionally, satisfactory soil for use in structural fill areas shall meet the following:
  1. Have a Plasticity Index of 20 or less and a Liquid Limit of 50 or less.
  2. Shall have a Standard Proctor Maximum Dry Density of 90-lb/cf or greater.
  3. Satisfactory soil materials obtained from off-site borrow sources shall meet all requirements listed above and possess a Standard Proctor Maximum Dry Density of 90-lb/cf or greater, shall contain at least 20% fines, and have a Plasticity Index of less than 20.
  4. CL and CH soils from on-site excavation may only be used as fill in non-structural areas.
- C. Unsatisfactory Soil Materials: ASTM D 2487 soil classification groups MH, ML, CH, CL, OL, OH, and PT. Soils having a Plasticity Index greater than 20 and a Liquid Limit greater than 50 are also unsatisfactory within structural areas except if placed as specified above.
- D. Unsuitable Soil: Refer to paragraph 1.5 of this Section.
- E. Backfill and Fill Materials: Satisfactory soil materials.
- F. Impervious Fill & Clay Liner: Clayey or silty soil mixtures capable of compacting to a dense state with a maximum permeability of 0.01-in/hr and compacted to at least 95% of the maximum dry density per ASTM D-698. ASTM D 2487 soil classification groups CH, CL, SC, MH, and ML; free of rock, brush, roots, and other organic material subject to decomposition.

### 2.2 PROCESSED AGGREGATE MATERIALS

- A. Base Course Material: Type A aggregate base course meeting the requirements of Section 520 of NCDOT "Standard Specifications for Roads and Structures."

- B. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- C. Bedding Material: #57 washed stone.
- D. Drainage Fill: #57 washed stone.
- E. Filtering Material: #57 washed stone.
- F. Coarse Sand: Grain Size Distribution (ASTM C136-95A):

<u>Sieve Size</u>	<u>Percent Passing</u>
3/8"	100
#4	95-100
#8	85-97
#16	60-80
#30	10-20
#50	5-15
#100	0-5

### 2.3 FLOWABLE FILL

- A. Flowable fill shall consist of a lean concrete mixture of portland cement, aggregate and water. Water reducing and air-entraining admixtures may be added at the option of the Contractor.
  1. Material shall comply with the requirements of Division 03 Section, Cast-in-Place Concrete.
  2. The proportions of the mix shall be determined by the Contractor to obtain a compressive strength of 100-300-psi at 28-days.

### 2.4 ACCESSORIES

- A. Drainage (Filter) Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
  1. Grab Tensile Strength: 110 lbf (490 N); ASTM D 4632.
  2. Tear Strength: 40 lbf (178 N); ASTM D 4533.
  3. Puncture Resistance: 50 lbf (222 N); ASTM D 4833.
  4. Water Flow Rate: 150 gpm per sq. ft. (100 L/s per sq. m); ASTM D 4491.
  5. Apparent Opening Size: No. 50 (0.3 mm); ASTM D 4751.
- B. Separation/Stabilization Fabric: Woven geotextile, specifically manufactured for use as a separation and or stabilization geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
  1. Grab Tensile Strength: 200 lbf (890 N); ASTM D 4632.
  2. Tear Strength: 75 lbf (333 N); ASTM D 4533.
  3. Puncture Resistance: 90 lbf (400 N); ASTM D 4833.
  4. Water Flow Rate: 4 gpm per sq. ft. (2.7 L/s per sq. m); ASTM D 4491.
  5. Apparent Opening Size: No. 30 (0.6 mm); ASTM D 4751.
- C. Biaxial Geogrid: Integrally formed biaxial geogrid, specifically manufactured for use as a base reinforcement for subgrade improvement. Tensar BX1100, Mirafi BXG-110, or approved equal with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
  1. Aperture Dimensions: 1-in (25-mm) nominal.
  2. Minimum Rib Thickness: 0.03-in (0.76-mm) nominal.
  3. Tensile Strength @ 2% Strain: 280-lb/ft (4.1 kN/m); ASTM D-6637.
  4. Tensile Strength @ 5% Strain: 580-lb/ft (8.5 kN/m); ASTM D-6637.
  5. Ultimate Tensile Strength: 850-lb/ft (12.4 kN/m); ASTM D-6637.

## 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. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- 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. Site Maintenance: The Contractor shall be responsible to take whatever measures are necessary to ensure reasonable accessibility to and on the construction site so that undue delays are avoided under normal weather conditions. These measures shall include, but not be limited to, the following:
  - 1. Maintaining the surface of the soils in a manner to promote drainage runoff and avoid ponding of water, especially prior to predicted rain events.
  - 2. Avoiding operation of temporary water sources or hoses in a manner which will cause unnecessary and repeated wetting of the site.
  - 3. Fill in severely rutted areas which are ponding water during the construction activities or after rain events with drainage fill material to assist drying and allow construction activities to continue.
  - 4. Provide drying of surface soils and soils intended for filling or backfilling as required to promote accelerated drying of those materials.
  - 5. After successful drying efforts or prior to predicted rain events, grade the areas back to a smooth condition to promote drainage runoff.
  - 6. Controlling vehicular traffic, both construction and personal on the site in a manner to prevent undue damage to soils whenever possible and practical.
  - 7. Providing temporary staging areas of crushed stone or other materials around the construction site which will better withstand the weather and traffic and keep the site accessible immediately or shortly after rain events.
  - 8. Provide de-watering equipment for any areas collecting water which may affect construction or soil densities under built areas.
  - 9. Any claims for weather related delays considered shall be considered with particular attention paid to the Contractor's efforts in regard to the above requirements

### 3.2 DEWATERING

- A. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
  - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
  - 2. Install a dewatering system to keep subgrades dry and convey groundwater away from excavations. Maintain until dewatering is no longer required.
- C. Design, furnish, install, test, operate, monitor, and maintain temporary dewatering systems of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
  - 1. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls as needed.
  - 2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
  - 3. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, prevention of flooding in excavation, and prevention of damage to subgrades and permanent structures.
  - 4. Prevent surface water from entering excavations by grading, dikes, or other means.

5. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
  6. Remove dewatering system when no longer required for construction.
- D. Soft wet soils, if present at the surface, shall be dried and compacted in place by the Contractor and be stable under proofrolling prior to placing fill. Drying shall be accomplished by discing, plowing or other means necessary and shall be included in the Contractor's bid. Site soils are typical of the area and susceptible to loss of strength if they become wet, resulting in softening and rutting during construction. Site soils are extremely moisture sensitive, therefore, the Contractor shall take active and aggressive steps to dry soil materials wet of optimum to maintain construction progress through the work and to maintain access to and around the construction. The Contractor, at his option and cost may remove unstable, wet materials and replace with available fill materials in lieu of accomplishing soil drying procedures.
- 3.3 EXPLOSIVES
- A. Explosives: Do not use explosives.
- 3.4 STABILITY OF EXCAVATIONS
- A. Comply with local codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations. Contractor is responsible for ensuring all excavation operations and other construction comply with applicable OSHA requirements. Contractor shall provide temporary shoring and bracing as needed to construct the proposed improvements and comply with the above requirements.
- 3.5 EXCAVATION FOR STRUCTURES
- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
- B. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
- 3.6 EXCAVATION FOR WALKS AND PAVEMENTS
- A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.
- 3.7 EXCAVATION FOR UTILITY TRENCHES
- A. Excavate trenches to indicated slopes, lines, depths, and invert elevations.
1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated.
1. Clearance: As indicated
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove stones and sharp objects to avoid point loading.
1. For pipes or conduit less than 6 inches (150 mm) in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
  2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
  3. Where encountering rock or another unyielding bearing surface, carry trench excavation 6 inches (150 mm) below invert elevation to receive bedding course.

- D. Soil excavated from trenches that is to be used as backfill or fill shall be moisture conditioned as needed prior to placement and compaction as backfill or fill.

### 3.8 APPROVAL OF SUBGRADE PRIOR TO PLACING FILL OR OTHER IMPROVEMENTS

- A. Notify Architect or Owner's independent testing agency when excavations have reached required subgrade.
- B. After stripping is complete the exposed subgrade shall be proofrolled with a fully loaded dual wheel tandem axle dump truck or similar construction equipment. Four passes shall be made in each orthogonal direction. The proofrolling operation shall be observed by the Architect or Owner's independent testing agency. Should any area fail to tighten up after proofrolling and continue to rut and/or pump, the soil shall be scarified and moistened or aerated and recompactd and/or densified in-place with a vibratory roller. Repeat proofrolling operations.
  - 1. Proofrolling in confined areas inaccessible to dump trucks shall be performed by other means as determined appropriate by the Owner's independent testing agency.
- C. When Architect or Owner's independent testing agency determines that unforeseen unsuitable soil is present, continue excavation and replace with compacted backfill or fill material as directed.
  - 1. Unforeseen additional excavation and replacement with suitable material approved by the Architect will be considered unsuitable material and will be paid by unit prices included in the Contract Documents. Refer to Division 1 Sections.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect. Install french drains at design subgrade if directed by the Owner's independent testing agency and approved by the Architect.

### 3.9 IN-PLACE DENSIFICATION OF EXISTING SOILS

- A. After stripping and removing topsoil and once any areas of cut have been excavated to proposed subgrade elevations, the exposed subgrade soils in the proposed building and pavement area shall be densified in-place with a medium weight vibratory roller to improve the support of the exposed subgrade soils. Three to six passes shall be made in each orthogonal direction. Vibratory rolling shall be performed during dry weather. If water is brought to the surface during vibratory rolling, discontinue rolling until the water subsides. The vibratory rolling operations shall be observed by the Owner's independent testing agency.
- B. Allow pore pressures to dissipate for at least 16 hours following completion of vibratory rolling. After waiting period, re-perform proofrolling of the densified area.

### 3.10 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending indicated bottom elevation of concrete foundation or footing to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position when acceptable to the Architect.
  - 1. Fill unauthorized excavations under other construction as directed by the Architect or the Owner's independent testing agency.
- B. Where indicated widths of utility trenches are exceeded, provide stronger pipe, or special installation procedures, as required by the Architect.

### 3.11 STORAGE OF SOIL MATERIALS

- A. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent wind-blown dust.
  - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

### 3.12 BACKFILL

- A. Backfill excavations promptly, but not before completing the following:
  - 1. Acceptance of construction below finish grade including, where applicable, damp-proofing, waterproofing, and perimeter insulation.
  - 2. Surveying locations of underground utilities for record documents.
  - 3. Testing, inspecting, and approval of underground utilities.
  - 4. Concrete formwork removal.
  - 5. Removal of trash and debris from excavation.
  - 6. Removal of temporary shoring and bracing, and sheeting.
  - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
  - 8. Removal of objectionable materials, including rocks larger than acceptable size, from backfill soils.

### 3.13 UTILITY TRENCH BACKFILL

- A. Place and compact bedding course on rock and other unyielding bearing surfaces and to fill unauthorized excavations. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- B. Pipe sleeves and concrete backfill trenches that carry below or pass under footings and that are excavated within 18 inches (450 mm) of footings. Place concrete to level of bottom of footings. Contact the Architect or the Owner's independent testing agency to coordinate details, procedures and possible alternatives.
- C. 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 installation and testing, completely encase piping or conduit in a minimum of 4 inches (100 mm) of concrete before backfilling or placing roadway base course.
- D. Place and compact initial backfill of satisfactory soil material or base course material, free of particles larger than 1 inch (25 mm), to a height of 12 inches (300 mm) over the utility pipe or conduit.
  - 1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.
  - 2. Moisture condition soil materials as needed prior to placement as backfill.
- E. Coordinate backfilling with utilities testing.
- F. Fill voids with approved backfill materials as shoring and bracing, and sheeting is removed.
- G. Place and compact final backfill of satisfactory soil material to final subgrade.
  - 1. Moisture condition soil materials as needed prior to placement as backfill.
- H. Install detectable warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

### 3.14 FILL

- A. Preparation: Remove vegetation, topsoil, debris, wet, frozen, and unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placing fills.
  - 1. Plow, strip or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing surface.
- B. Obtain approval of subgrade as specified prior to placing fill.
- C. Obtain approval of fill materials. Remove all objectionable materials, including stones larger than acceptable size, from fill materials.
- D. Place fill material in layers to required subgrade elevations for each location listed below.
  - 1. Under grass, use satisfactory excavated or borrow soil material.

2. Under walks, pavements, buildings and other structural areas use base course material, or satisfactory excavated or borrow soil material.
  3. In pond embankments, use impervious fill for core/cut-off trench and suitable soil for remainder of embankment.
- E. Following placement of fill the subgrade of building and pavement areas shall be proofrolled as described in the Field Quality Control section. The proofrolling operation shall be observed by the Owner's testing agency. Should any area fail to tighten up after proofrolling and continue to rut and/or pump, the soil shall be scarified and moistened or aerated and recompacted. Repeat proofrolling operations.
- F. Overbuild Deep Fill Slopes: Fill slopes shall be overbuilt a sufficient distance and then cut back to achieve required compaction at the design slope surface.

### 3.15 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 3 percent of optimum moisture content.
1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
  2. Remove and replace or scarify and air-dry satisfactory soil material that is too wet to compact to specified density.
    - a. Stockpile or spread and dry removed wet satisfactory soil material.

### 3.16 COMPACTION

- 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 (100 mm) in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure.
- C. Percentage of Maximum Dry Density Requirements: Compact soil to not less than the following percentages of maximum dry density according to ASTM D698 Standard Proctor:
1. Under structures, steps, walks, and pavements:
    - a. Compact each layer of backfill or fill material at 95% of the standard Proctor Density (ASTM D-698).
    - b. Compact each layer of the final 12-in of backfill material in building and pavement areas at 98% of the standard Proctor Density (ASTM D-698).
    - c. Moisture content of the fill during placement shall be kept within +/-3% of optimum.
    - d. Under pavements within NCDOT rights-of-way or new pavement to be constructed to NCDOT standards compact the top 8 inches below pavement subgrade to at least 100% density in accordance with AASHTO T-99 as modified by NCDOT.
  2. Under lawn or unpaved areas, compact the top 6 inches below subgrade and each layer of backfill or fill material at 92 percent maximum dry density.
  3. Compact each layer of aggregate base material under pavement to 100% density in accordance with AASHTO T-180 as modified by NCDOT or to at least 98% of the nuclear target density as specified in section 520 of the NCDOT Standard Specifications for Roads and Structures.

### 3.17 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
1. Provide a smooth transition between existing adjacent grades and new grades.
  2. Cut out soft spots, fill low spots, and trim high spots to conform to required surface tolerances.
- B. 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 1.2 inches (0.10 foot).

2. Walks: Plus or minus 1.2 inches (0.10 foot).
3. Pavements: Plus or minus 1/2 inch (0.05 foot).
4. Pond Embankments: Construct embankment to an elevation 10% higher than the design height to allow for settling.
5. Athletic/Play Fields:
  - a. Subgrade: Plus or minus 1.2 inches (0.10 foot).
  - b. Final Grade (Topsoil): Plus or minus 1/2 inch (0.05 foot) when tested with a 10 foot straightedge.

- C. Lawn Fine Grading: Finish grade lawn and landscape areas to a smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future. Remove trash, debris, stones larger than 1/2 inch in any dimension, and other objects that may interfere with planting or maintenance operations.

### 3.18 SUBSURFACE / FOUNDATION DRAINAGE

- A. Drainage Piping: Drainage pipe is specified in Division 33 Section "Site Storm Drainage Utilities."
- B. Subsurface Drain: Place a layer of drainage fabric around perimeter of drainage trench as indicated. Place a course of drainage fill material on drainage fabric to support drainage pipe. Encase drainage pipe in drainage fill material and wrap in drainage fabric, overlapping sides and ends at least 6 inches.
  1. Compact each course of drainage fill material.
  2. Place satisfactory excavated or borrow soil material or topsoil fill material (as appropriate) over drain to final grade.

### 3.19 BASE COURSES

- A. Under pavements, walks, courts and tracks, place base course material on prepared subgrades.
  1. Where indicated, place biaxial geogrid directly on prepared subgrade under all asphalt and concrete pavement without wrinkles or folds. Seams shall be overlapped a minimum of 12-in. Geogrid placement shall be observed by the Owner's Independent Testing Agency prior to covering. Place compacted base course over geogrid and control traffic and operation of equipment over geogrid and base course in accordance with manufacturer's instructions.
  2. Compact base courses at optimum moisture content to required grades, lines, cross sections and thickness to not less than 100 percent density in accordance with AASHTO T-180 as modified by NCDOT or to at least 98% of the nuclear target density as specified in section 520 of the NCDOT Standard Specifications for Roads and Structures.
  3. Shape base course to required crown elevations and cross-slope grades.
  4. When thickness of compacted base course is 6 inches or less, place materials in a single layer.
  5. When thickness of compacted base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick when compacted.
  6. Following compaction testing and within 48 hours prior to the application of asphalt or concrete pavement, the aggregate base course shall be proofrolled with a fully loaded dual wheel tandem axle dump truck or similar construction equipment. Four passes shall be made in each orthogonal direction. The proofrolling operation shall be observed by the Architect or Owner's independent testing agency. Should any area fail to tighten up after proofrolling and continue to rut and/or pump, the base course shall be scarified and moistened or aerated and recompacted. Repeat proofroll testing.
    - a. Proofrolling in confined areas inaccessible to dump trucks shall be performed by other means as determined appropriate by the Owner's independent testing agency.
- B. Pavement Shoulders: Place shoulders along edges of base course to prevent lateral movement. Construct shoulders at least 12 inches (300 mm) wide of acceptable soil materials and compact simultaneously with each base course layer.

### 3.20 FIELD QUALITY CONTROL

- A. Owner's Independent Testing Agency Services: Allow testing agency to evaluate and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.

1. Perform testing and evaluation of borrow or fill soils for compliance with material specifications of this Section.
  2. Perform field in-place density tests according to ASTM D 1556 (sand cone method), ASTM D6938 (nuclear gauge method) or equal as determined by the Owner's independent testing agency.
    - a. Structural Areas: At subgrade and at each compacted fill, backfill layer, and aggregate base course layer, perform at least one field in-place density test for every 2,500 sq.ft. or less of building area and every 5,000 sq.ft. or less of paved area, but in no case fewer than three tests. Observe proofrolling of finished subgrade and aggregate base course.
    - b. Trench Backfill: Perform at least one field in-place density test per 2 feet of backfill per 100 linear feet or less of trench outside of limits of buildings, but no fewer than two tests per trench per day.
    - c. Non-Structural Areas: Field density and moisture content tests shall be performed on the fill and backfill at a rate of at least one test per every 15,000 square feet of area being filled.
  3. Building Foundation Excavations: Evaluate bearing subgrades with hand augers and Dynamic Cone Penetrometer (DCP) testing.
  4. Observe proof-rolling as described herein.
  5. Refer to Special Inspections section below for testing within building limits.
- B. When testing agency reports that subgrades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, recompact and retest until required density is obtained. Contractor shall be responsible for all costs associated with re-testing required due to failed compaction.
- C. Proofrolling: Subgrade to receive fill, finish subgrade of building or pavement areas, and aggregate base courses shall be proofrolled with a fully loaded dual wheel tandem axle dump truck or similar construction equipment. Four passes shall be made in each orthogonal direction. The proofrolling operation shall be observed by the Owner's testing agency. Should any area fail to tighten up after proofrolling and continue to rut and/or pump, the soil shall be scarified and moistened or aerated and recompact. Repeat proofrolling operations.
1. Proofrolling in confined areas inaccessible to dump trucks shall be performed by other means as determined appropriate by the Owner's independent testing agency.

### 3.21 SPECIAL INSPECTIONS

- A. Allow Special Inspections and tests to be performed by the Special Inspector or Special Inspection Agency.
- A. Verification and inspection of earthwork construction shall be in accordance with the applicable sections of the current North Carolina State Building Code, and as follows:
1. Review laboratory test reports, certificates of compliance, or other data submitted to show compliance with specifications, and conduct field inspections and tests during earthwork operations as necessary to verify compliance with the contract documents.
  2. All site stripping and proofrolling operations shall be observed and monitored. Verify suitability of subgrade prior to installation of fill.
  3. At footing subgrades, test each soil stratum to verify design bearing capacities. Verification and approval of footing subgrades may be based on a comparison of subgrade with test data. Perform additional testing as necessary.
  4. Test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
    - a. Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of building slab, but in no case fewer than three tests.
    - b. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 50 feet or less of wall length, but no fewer than two tests.
    - c. Trench Backfill in Building Areas: At each compacted initial and final backfill layer, at least one test for every 50 feet or less of trench length, but no fewer than two tests.
- B. Allow Special Inspector to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements

- C. When subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.
- D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- E. Additional testing performed to determine compliance of corrected work with specified requirements shall be at Contractor's expense.

### 3.22 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.
  - 1. Scarify or remove and replace material to depth directed by the Architect or Owner's independent testing agency; reshape and recompact at optimum moisture content to the required density.
- C. Settling: Where settling occurs during the Project correction period, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

### 3.23 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner's property.

END OF SECTION 31 20 00

**SECTION 31 25 00**  
**EROSION & SEDIMENT CONTROLS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes the following: Soil erosion and sedimentation control for all areas of the site that are graded or disturbed by any construction operations and elsewhere as indicated on the Drawings or specified herein. Erosion control shall be as specified herein and as may be required by actual conditions and governing authorities.
- B. The Contractor is fully responsible for all applicable permits and approvals for off-site borrow and waste areas.
- C. The Contractor shall have full responsibility for the construction and maintenance of erosion control and sedimentation control facilities as shown on the Drawings and as specified herein. The Contractor shall at all times provide the operation and maintenance necessary to operate the permitted sediment and erosion controls at optimum efficiency.
- D. The Contractor shall provide permanent or temporary ground cover as soon as possible over disturbed areas of the site, and shall provide permanent or temporary ground cover in no more than 14 days after construction activities have permanently or temporarily ceased over the disturbed area. Temporary or permanent ground cover shall be provided on slopes within 7 days after construction activities have permanently or temporarily ceased.
- E. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 31 Section "Site Clearing"
  - 2. Division 31 Section "Earth Moving"
  - 3. Division 32 Section "Planting"

**1.3 SUBMITTALS**

- A. General: Submit the following according to the Conditions of the Contract and Division 01 Specification Sections.
  - 1. Silt fence fabric, wire support and posts.
  - 2. Tree protection fence, signs and posts.
  - 3. Filter fabric.
  - 4. Channel and slope matting.
  - 5. Compost filter socks.
  - 6. Manufactured inlet sediment control devices.
  - 7. Dewatering silt bags.

**1.4 PRODUCT HANDLING**

- A. Deliver seed, fertilizer and other packaged materials in unopened original packages with labels legible and intact. Seed packages shall bear a guaranteed analysis by a recognized authority.
- B. On-site storage of materials shall be kept to a minimum. Wet or damaged seed or other material shall be removed from the project site immediately.

**1.5 MONITORING AND RECORD KEEPING**

- A. Contractor shall abide by all conditions of the General Permit to Discharge Stormwater under the National Pollutant Discharge Elimination System (NPDES), Permit No. NCG010000 (obtain copy from Owner) and the general requirements listed below. NPDES General Permit No. NCG01000 can be viewed at:

- B. All sediment and erosion control devices and facilities shall be inspected at least once every seven (7) calendar days and within 24 hours after any storm event of greater than 0.5 inches of rain per 24 hour period.
- C. Stormwater discharges shall be inspected by observation for stormwater discharge characteristics (as listed below) at the above frequency to evaluate the effectiveness of the sediment control facilities, devices or practices. Observations shall be made at all stormwater discharge outfalls and other locations where concentrated stormwater discharges from the site. Observations shall be qualitative, no analytical testing or sampling is required. If any visible off-site sedimentation is leaving the site, corrective action shall be taken to reduce the discharge of sediments.
  - 1. Color.
  - 2. Odor.
  - 3. Clarity.
  - 4. Floating solids.
  - 5. Suspended solids.
  - 6. Foam.
  - 7. Oil sheen.
  - 8. Other obvious indicators of stormwater pollution.
- D. The contractor shall perform and keep records of the above inspections. Visible sedimentation found off the site shall be recorded with a brief explanation as the measures taken to prevent future releases as well as any measures taken to clean up the sediment that has left the site. This record shall be made available to the Owner, Architect and governmental authorities.

## PART 2 - PRODUCTS

### 2.1 SOIL AMENDMENTS AND SEED

- A. Refer to Division 32 Section "Planting".

### 2.2 MISCELLANEOUS

- A. Gravel for Stone Filters: Washed No. 57 stone or as indicated on the drawings.
- B. Silt Fence Fabric: A synthetic filter fabric or a pervious sheet of polypropylene, nylon, polyester, or polyethylene yarn, which is certified by the manufacturer or supplier as conforming to the following requirements.
  - 1. Tensile Strength (Grab): 90 x 90-lbs. min., ASTM D 4632.
  - 2. Permittivity: 0.05-sec<sup>-1</sup> min., ASTM D 4491.
  - 3. Apparent Opening Size: #30 US Sieve (0.60-mm) max., ASTM D 4751.
  - 4. UV Resistance (500-hrs): 70%, ASTM D 4355.
- C. Filter Fabric (for installation under riprap): Woven geotextile fabric, apparent opening size no larger than US Standard Sieve no. 70, min. grab strength of 120-lbs.
- D. Dewatering Silt Bag: Permeable, non-woven geotextile bag manufactured to accept and filter pumped, sediment-laden water from dewatering activities. Silt bag shall be sized as appropriate for the dewatering pump discharge rate and shall be fitted with a fill spout large enough to accommodate the discharge piping of the dewatering pump. Silt bag shall be Dirtbag as manufactured by ACF Environmental, Inc. or approved equal.
- E. Compost Filter Sock: Three-dimensional tubular sediment control device comprised of an organic compost filter media contained in a tubular knitted mesh sock.
  - 1. Filter media shall be mature compost that has been certified by the US Composting Council's Seal of Testing Assurance Program and meeting the following specifications.
    - a. pH: 5.0 – 8.5.

- b. Moisture Content: < 60%.
  - c. Organic Matter: >25%, dry weight.
  - d. Particle Size: 99% passing 2-in sieve, 30-50% passing 3/8-in sieve.
- 2. Filter sock netting shall be 5-mm thick continuous HDPE filament, tubular knitted mesh with 3/8-in openings. Filled sock shall be a minimum of 12-in in diameter.
  - 3. Stakes shall be 2x2-in x 3-ft wooden stakes.

## 2.3 INLET PROTECTION MEASURES

- A. **Manufactured Inlet Sediment Control Device:** Storm drainage inlet sediment control device shall be manufactured from woven polypropylene geotextile to fit the opening of a catch basin or drop inlet to filter sediment from runoff entering the inlet. The device shall be a High Flow Siltsack as manufactured by ACF Environmental, Inc. or approved equal. Device shall be provided with an integral curb deflector if installed at a catch basin with a vertical opening adjacent to a horizontal grate.
- B. **Floor Drain / Area Drain Sediment Filter Device:** Small size storm drainage inlet sediment control device shall be manufactured from woven polypropylene geotextile to fit into small diameter floor drains to filter sediment from runoff entering the inlet. The device shall be a Round Drain Insert as manufactured by New Pig Corp. or approved equal.

## 2.4 CHANNEL AND SLOPE MATTING

- A. **Channel Matting:** Erosion Control blankets for installation in channels shall be a machine-produced mat of curled wood fiber (excelsior) or synthetic polypropylene fiber as specified below. The blanket shall be of consistent thickness with the fiber evenly distributed over the entire area of the mat. The blanket shall be covered with a photo degradable plastic netting secured to the fiber mat. Channel liners shall be excelsior mat unless otherwise indicated on the drawings.
  - 1. **Excelsior Mat:**
    - a. **Fiber:** Curled wood excelsior of 80% six inch or longer fiber length with a consistent width of fibers evenly distributed throughout the mat. Mat shall be smolder resistant with no chemical additives.
    - b. **Top and Bottom Netting:** Photo degradable extruded plastic netting with maximum mesh size of 3/4" x 3/4".
  - 2. **Wire Staples:** 16 gauge steel wire, with minimum of 3" top and 6" long legs. 1.75 staples per square yard of matting minimum.
- B. **Slope Matting:** Erosion Control blankets for installation on slopes (not channels) shall be a machine-produced mat of crimped wood fiber and/or other degradable fibers manufactured without nets or threads. Staples or stakes used to secure the mat shall be wood or 100% biodegradable natural material. No nets or metal staples shall be used on any areas other than within channels.
  - 1. **Excelsior Mat:**
    - a. **Fiber:** Net-free, curled wood excelsior of 80% six inch or longer fiber length with a consistent width of fibers evenly distributed throughout the mat. Mat shall be smolder resistant with no chemical additives.
  - 2. **Stakes or Staples:** Wood or 100% biodegradable natural material with additive to cause breakdown and 100% degradation within 24-36 months after installation.

## 2.5 RIPRAP

- A. **Riprap:** Provide riprap of the class and quantity indicated on the Drawings. While no specific gradation is required, the various sizes of the stone shall be equally distributed within the required size range. The size of an individual stone shall be determined by measuring its long dimension. Stone shall meet the requirements of the following table for class and size distribution. No more than 5% of the material furnished can be less than the minimum size specified nor no more than 10% of the material can exceed the maximum size specified.

REQUIRED STONE SIZES - INCHES			
CLASS	MINIMUM	MIDRANGE	MAXIMUM
A	2	4	6
B	5	8	12
1	5	10	17
2	9	14	23

### PART 3 - EXECUTION

#### 3.1 GENERAL

##### A. Existing Structures and Facilities

- Existing structures, facilities, and water courses shall be protected from sedimentation.
- The Contractor shall be responsible for the construction of necessary measures, and all costs shall be at the expense of the Contractor.
- Items to be protected from sedimentation deposits shall include, but are not limited to, all downstream property, natural waterways, streams, lakes and ponds, catch basins, drainage ditches, road gutters, and natural buffer zones.
- Control measures such as the erection of silt fences, barriers, dams, or other structures shall begin prior to any land disturbing activity. Additional measures shall be constructed as required during the construction.
- All facilities installed shall be maintained continuously during construction until the disturbed areas are stabilized. Contractor shall remove all erosion control measures at the end of the project at his expense unless otherwise directed by the Owner or his representative.
- Perform monitoring and record keeping as specified in this section.

#### 3.2 PROTECTIVE MEASURES

##### A. Protective measures shall conform to all State and Local requirements.

##### B. Construction and maintenance of sediment and erosion control measures shall be in accordance with all applicable laws, codes, ordinances, rules and regulations.

- Silt Fence: Hog wire or wire mesh fastened to posts as recommended by the Manufacturer and covered with silt fabric.
- Berms and Diversion Ditches: These shall be graded channels with a supporting ridge on the lower side constructed across a sloping land surface. Diversion ditches and berms shall be planted in vegetative cover as soon as completed.
- Mulching: Mulching shall be used to prevent erosion and to hold soil and seed in place during the establishment of vegetation.
- Matting: Temporary slope and channel matting shall be used for temporary stabilization during the establishment of seeded cover in all grassed ditches, channels, long slopes, and steep banks (6:1 or steeper) and additional areas as indicated on plans.** Matting shall be installed on any area on site as needed to provide temporary stabilization whether or not matting is indicated on the plan. Install as indicated or per manufacturer's instructions. The installation of matting may be waived by the Architect if surface stabilization is obtained by other methods within the appropriate and agreed time frames. If adequate stabilization is not obtained, the Contractor shall install matting where required at no additional cost to the Owner.
- Build Berm, Pits and Gravel Filter as shown on Drawings. Maintain during construction to keep erosion and sedimentation to a minimum. When it is necessary to remove berm, pits, and gravel, return area to required profiles and condition.
- Construction Entrances: Construct all entrances in accordance with plans. Maintain all ingress/egress points to prevent tracking of soil onto the Owner's, public or private roads. Any soil that is tracked onto the roads shall be removed immediately.
- Riprap: Stone shall be graded so that the smaller stones are uniformly distributed throughout the mass. Stone may be placed by mechanical methods, augmented by hand placing where necessary, provided that when the riprap is completed it forms a properly graded, dense, neat layer of stone.
- Manufactured Inlet Sediment Control Device: Install device in accordance with manufacturer's instructions and install a curb deflector if appropriate. Inspect device after each rain event and at intervals not exceeding two weeks during construction. Remove, empty, clean, and replace the

device as needed during construction. Empty collected sediment in approved, protected location. Remove and dispose of device following full and permanent stabilization of the contributing drainage area.

9. Dewatering Silt Bag: Install silt bag on an undisturbed slope so incoming water flows downhill through the bag without causing erosion. Remove and replace silt bag when device no longer drains efficiently due to accumulated sediment in bag. Empty bag within disturbed limits of the site protected by other sediment control measures.
10. Compost Filter Logs: Stake filter log every 10-ft. Drive stakes through the center of the log and 1-ft into the ground. If sock netting must be joined, fit beginning of the new sock over the end of the old sock, overlapping by 1-2 ft. Fill with compost and stake the joint.
11. Other Measures: Other methods of protecting existing structures and facilities, such as vegetative filter strips, diversions, rip-rap, baffle boards, and ditch checks used for reduction of sediment movement and erosion, may be used at the option of the Contractor when approved by the appropriate State or local authorities.

C. Provide the following, at a minimum, to prevent windblown dust.

1. Apply straw mulch and establish temporary or permanent ground cover on exposed soil where work is not being actively performed.
2. Cover or establish vegetative cover on stockpiles.
3. Apply water or other approved dust suppressant as needed to soil surfaces before they become excessively dry.
4. Sweep and collect soil that has been tracked onto paved surfaces.

### 3.3 STABILIZATION

- A. Permanently protect stabilized areas prior to the removal of protective devices.
- B. After the final establishment of permanent stabilization, remove temporary sediment control measures. Re-spread accumulated sediments as specified.
- C. Permanently stabilize all areas disturbed by the removal and re-spreading operations immediately.

### 3.4 TEMPORARY SEEDING

- A. In accordance with the schedule as detailed on the drawings.

### 3.5 PERMANENT SEEDING

- A. In accordance with the schedule as detailed on the drawings.

### 3.6 MULCHING AND MATTING

- A. Apply mulch or matting to retain soil and grass.
- B. Mulch areas with slope greater than 5% by spreading a light cover of mulch over seeded area at the rate of not less than 85 lbs. per 1000 sq. ft.
- C. Install temporary matting in all grassed ditches, channels, long slopes, and steep banks (6:1 or steeper) and additional areas indicated on plans or where extra protection from erosion is needed.

END OF SECTION 31 25 00

## **SECTION 31 3116 TERMITE CONTROL**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Chemical soil treatment.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete: Vapor barrier placement under concrete slab-on-grade.

#### **1.03 REFERENCE STANDARDS**

- A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act; 2022.

#### **1.04 SUBMITTALS**

- A. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements.
- C. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

#### **1.05 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing this type of work and:
  - 1. Having minimum of three (3) years documented experience.
  - 2. Licensed in the State in which the Project is located.

#### **1.06 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year installer's warranty against damage to building caused by termites.
  - 1. Inspect annually and report in writing to Owner. Provide inspection service for five years from Date of Substantial Completion.

### **PART 2 PRODUCTS**

#### **2.01 CHEMICAL SOIL TREATMENT**

- A. Toxicant Chemical: EPA Title 7, United States Code, 136 through 136y approved; synthetically color dyed to permit visual identification of treated soil.
- B. Diluent: Recommended by toxicant manufacturer.
- C. Manufacturers:
  - 1. Bayer Environmental Science Corp: [www.backedbybayer.com/pest-management/#sle](http://www.backedbybayer.com/pest-management/#sle).
  - 2. FMC Professional Solutions: [www.fmcprosolutions.com/#sle](http://www.fmcprosolutions.com/#sle).
  - 3. Syngenta Professional Products: [www.syngentaprofessionalproducts.com/#sle](http://www.syngentaprofessionalproducts.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- D. Mixes: Mix toxicant to manufacturer's instructions.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.
- B. Verify final grading is complete.

#### **3.02 APPLICATION - CHEMICAL TREATMENT**

- A. Comply with requirements of U.S. EPA and applicable state and local codes.

- B. Spray apply toxicant in accordance with manufacturer's instructions.
- C. Apply toxicant at following locations:
  - 1. Under Slabs-on-Grade.
  - 2. At Both Sides of Foundation Surface.
- D. Under slabs, apply toxicant immediately prior to installation of vapor barrier.
- E. At foundation walls, apply toxicant immediately prior to finish grading work outside foundations.
- F. Re-treat disturbed treated soil with same toxicant as original treatment.
- G. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

### **3.03 PROTECTION**

- A. Do not permit soil grading over treated work.

**END OF SECTION 31 3116**

**SECTION 32 12 16  
ASPHALT PAVING**

**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 this Section.

**1.2 SUMMARY**

- A. This Section includes provisions for hot-mixed asphalt paving over prepared subbase.

**1.3 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Material Certificates signed by material producer and Contractor, certifying that each material item complies with or exceeds specified requirements of NCDOT "Standard Specifications for Roads and Structures".
- C. Job Mix Formula: Provide Geotechnical consultant with two copies of the proposed job mix formula at least ten days prior to beginning work. This formula shall be approved by NCDOT for the type of pavement specified.
- D. Recycled Content: 15% minimum, or as approved by NCDOT except as noted below.

**1.4 SITE CONDITIONS**

- A. Weather Limitations for Prime and Tack Coats: Apply prime and tack coats only when the surface to be treated is dry and when the atmospheric temperature measured at the location of paving operations away from artificial heat are in compliance with current NCDOT Standard Specifications for Roads and Structures. Do not apply tack coat when weather is foggy or rainy.
- B. Weather Limitations for Asphalt Courses: Apply hot-mixed asphalt surface, intermediate and base courses when surface and air temperatures are in compliance with current NCDOT Standard Specifications for Roads and Structures and when base is dry.
- C. Grade Control: Establish and maintain required lines and elevations.
- D. Traffic Control: Provide traffic control devices, lane closures, positive protection and/or any other warning or positive protection devices necessary for the safety of road users and pedestrians during construction.
  - 1. Traffic control shall be performed in conformance with the latest NCDOT Roadway Standard Drawings and Standard Specifications for Roads and Structures and the Manual on Uniform Traffic Control Devices for Streets and Highways.
  - 2. Sidewalk closures shall be installed as necessary. Pedestrian traffic shall be detoured around these closures and shall be signed appropriately and in accordance with ADA guidelines.
  - 3. Two-way traffic shall be maintained at all times through use of flagmen when necessary.
  - 4. Maintain access for fire-fighting equipment and access to fire hydrants.

**1.5 QUALITY ASSURANCE**

- A. All materials, construction methods and testing shall comply with the requirements of the latest editions of the North Carolina Department of Transportation (NCDOT) "Standard Specifications for Roads and Structures" and the Asphalt Handbook Manual Series No. 4 (MS-4).
- B. All work within any NCDOT right-of-way shall conform to the provisions and conditions of the NCDOT encroachment agreement(s) and driveway permit(s) and other applicable NCDOT standards and policies.

The encroachment agreement(s) and driveway permit(s) are considered part of the project specifications by reference. Copies of the agreement(s) and permit(s) will be provided upon request from the Architect.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Use locally available materials and gradations that comply with the requirements of the NCDOT "Standard Specifications for Roads and Structures" and exhibit a satisfactory record of previous installations.
- B. Aggregate Base Course (ABC): Type A aggregate base course meeting the requirements of the latest version of NCDOT "Standard Specifications for Roads and Structures."
- C. Superpave Asphalt Paving Mix: Superpave base, intermediate and surface asphalt paving mix meeting the requirements of the latest version of NCDOT "Standard Specifications for Roads and Structures." Types as indicated on the drawings.
- D. Tack Coat: Asphalt material meeting the requirement of the latest version of NCDOT "Standard Specifications for Roads and Structures."
- E. Parking Lot Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes.
  - 1. Color: White for parking lot striping.
  - 2. Color: Yellow for fire lanes and service area striping.
- F. Roadway Pavement Marking Paint: Thermoplastic Alkyd/Maleic and Hydrocarbon type, meeting the requirements of Section 1087 of NCDOT "Standard Specifications for Roads and Structures."
  - 1. Color: As indicated on the drawings.

## PART 3 - EXECUTION

### 3.1 SURFACE PREPARATION

- A. General: Remove loose material from compacted subbase surface immediately before applying base courses of asphalt.
- B. Proof-roll prepared subgrade surface as described in Section "Earth Moving" to check for unstable areas and areas requiring additional compaction.
- C. Do not begin paving work until deficient subbase areas have been corrected and are ready to receive paving. Ensure subgrade is graded for proper drainage. Repair as needed to avoid ponding on final pavement surfaces.
- D. Cold mill surfaces of existing pavements in locations and to depths as indicated on the drawings and as follows.
  - 1. At edges of existing pavement to be overlaid: Cold mill surfaces of existing pavements to a minimum depth of 1.5-inches at longitudinal terminus of asphalt overlays for a minimum width of 10 feet (extend terminus milling width to 100-ft on public roads) and at horizontal terminus (including along gutter line of existing curbs adjacent to asphalt overlays) for a minimum width of 6 feet to allow a smooth transition from full-depth thickness of overlay course to existing pavement or gutter surface. Thoroughly remove all loose material from milled surface before placing tack coat.
  - 2. At pavement to be wedge overlaid: Cold mill surfaces of existing pavements to required depths at edges of asphalt wedge sections on public roads for widths needed to allow minimum depth thickness of wedge course. Thoroughly remove all loose material from milled surface before placing tack coat.
  - 3. At butt joint of new asphalt to existing asphalt: Cold mill surfaces of existing pavements to a minimum depth of 1.5-inches for a minimum width of 18-inches along length of new joint to allow new asphalt surface to be keyed-in to the existing pavement. Thoroughly remove all loose material from milled surface before placing tack coat.

- E. Thoroughly remove all dust and loose material from surfaces of that which the tack coat is to be applied along with adjacent surfaces before placing tack coat.
- F. Apply tack coat to all contact surfaces of milled asphalt, existing asphalt to be overlaid, and surfaces abutting or projecting into hot-mixed asphalt pavement including the vertical face of adjacent concrete gutter. Distribute evenly and thoroughly at a rate of 0.04 to 0.08 gallons per sq. yd. of surface.
  - 1. Apply only as much tack coat as can be covered during the same day's operation.
  - 2. Take necessary precautions to limit the tracking and/or accumulation of tack coat material on either existing or newly constructed pavements. Excessive accumulation of tack may require corrective measures.
  - 3. Apply tack coat material with a distributor spray bar that can be adjusted to uniformly coat the entire surface at the directed rate. Use hand hose attachments only on irregular area and areas inaccessible to the spray bar. Cover these areas uniformly and completely.
  - 4. Apply tack coat to contact surfaces of gutters, concrete pavements, manholes, vertical faces of old pavements, and all exposed transverse and longitudinal edges of each course before mixture is placed adjacent to such surfaces.
  - 5. Cover curbs, adjacent concrete, and all other appurtenances to protect them from tracking or splattering tack coat material.
  - 6. Do not place any asphalt mixture until the tack coat has sufficiently cured.
- G. Allow to dry until at proper condition to receive paving.
- H. Exercise care in applying bituminous materials to avoid smearing of adjoining concrete surfaces. Remove and clean damaged surfaces.
- I. Place aggregate base courses as specified in Section "Earth Moving".

### 3.2 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd.
  - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
  - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- C. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

### 3.2 PLACING MIX

- A. Limitations: Do not produce or place asphalt mixtures during rainy weather, when the subgrade or base course is frozen, or when the moisture on the surface to be paved would prevent proper bond. Comply with all NCDOT weather and temperature limitations.
- B. General: Place hot-mixed asphalt mixture on prepared surface, spread, and strike off. Spread mixture at minimum temperature of 225 deg F. Place areas inaccessible to equipment by hand. Place each course to required grade, cross-section, and compacted thickness.
- C. Paver Placing: Place in strips not less than 10 feet wide, unless otherwise acceptable to Architect. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete base course for a section before placing surface course.
- D. Immediately correct surface irregularities in finish course behind paver. Remove excess material forming high spots with shovel or lute.

- E. Joints: Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density, and smoothness as other sections of hot-mixed asphalt course. Clean contact surfaces and apply tack coat.

### 3.3 ROLLING

- A. General: Begin rolling when mixture will bear roller weight without excessive displacement.
- B. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.
- C. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling and repair displaced areas by loosening and filling, if required, with hot material.
- D. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been evenly compacted.
- E. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained required density. Compact the asphalt to at least the minimum percentage of the maximum specific gravity listed below unless otherwise allowed by NCDOT.
  - 1. SF-9.5A: 90.0% of Maximum Specific Gravity
  - 2. S-9.5B/C, I-19.0B/C, B-25.0B/C: 92.0% of Maximum Specific Gravity.
- F. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot hot-mixed asphalt. Compact by rolling to specified surface density and 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.

### 3.4 TRAFFIC MARKINGS

- A. Cleaning: Sweep and clean surface to eliminate loose material and dust.
- B. Materials: Use thermoplastic marking for permanent markings on public streets and stop bars and crosswalks on private drives and parking lots. Use marking paint for parking and fire lane striping and other markings on private drives and parking lots.
- C. Apply traffic paint with mechanical equipment to produce uniform straight edges. Apply at manufacturer's recommended rates to provide minimum 12 to 15 mils dry thickness.
- D. Apply thermoplastic markings using application equipment constructed to assure continuous uniformity in the thickness and width of the thermoplastic pavement marking. Use equipment that provides multiple width settings ranging from 4 inches to 12 inches and multiple thickness settings to achieve the pavement marking thickness ranging from 0.090 inch to 0.120 inch. Comply with all applicable NCDOT standards.

### 3.6 FIELD QUALITY CONTROL

- A. General: Testing of asphalt concrete mix and in-place hot-mixed asphalt courses for compliance with requirements for thickness and surface smoothness will be done by Owner's testing laboratory in accordance with Division 1 Section "Quality Control." Repair or remove and replace unacceptable paving as directed by Architect.
  - 1. Owner's Independent Testing Agency will conduct and interpret tests and state in each report whether tested work complies with or deviates from the specified requirements.
- B. Thickness: In-place compacted thickness of each layer of asphalt shall be tested in accordance with ASTM D 3549. Results shall be considered unacceptable if the compacted thickness of any one core sample is greater than 1/2-inch below the thickness specified on the drawings or if the average thickness of all core samples is less than the thickness specified on the drawings.

- C. Surface Smoothness: Test finished surface of each hot-mixed asphalt course for smoothness, using 10 feet straightedge applied parallel with and at right angles to centerline of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness:
1. Base Course Surface: 1/4 inch.
  2. Wearing Course Surface: 3/16 inch.
  3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.
- D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979 or AASHTO T 168.
1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
  2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
    - a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
    - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- E. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.
- F. Contractor shall repair all test core holes with full depth asphalt patch.
- G. Perform ponding water tests. Repair areas of pavement that pond water.
- H. Check surface areas at intervals as directed by Architect.

END OF SECTION 32 12 16

**SECTION 32 13 13  
CONCRETE PAVING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes exterior portland cement concrete paving for the following:
  - 1. Curbs and gutters, pavement, walkways, service court, dumpster pads.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 31 Section "Earth Moving" for subgrade preparation, grading and subbase course.
  - 2. Division 03 Section "Cast-in-Place Concrete" for general building applications of concrete.
  - 3. Division 07 Section "Sealants and Caulking" for joint fillers and sealants within concrete paving and at joints with adjacent construction.

**1.3 SUBMITTALS**

- A. General: Submit the following according to the Conditions of the Contract and Division 01 Specification Sections.
- B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, joint systems, curing compounds, dry-shake finish materials, and others if requested by Architect.
- C. Design mixes for each class of concrete. Include percentage of recycled content (20% minimum). Include revised mix proportions when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
- D. Scaled plan of proposed construction, expansion and control joint locations in concrete pavement and concrete sidewalk. Submittal of plans for joints in curb and gutter or longitudinal sidewalk 6-feet or less in width is not required.

**1.4 QUALITY ASSURANCE**

- A. Concrete Standards: Comply with provisions of the following standards, except where more stringent requirements are indicated.
  - 1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
  - 2. ACI 318, "Building Code Requirements for Reinforced Concrete."
  - 3. ACI 330R, "Guide for the Design and Construction of Concrete Parking Lots."
  - 4. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."
- B. Concrete Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
- C. Concrete Testing Service: Engage a qualified independent testing agency to perform materials evaluation tests and to design concrete mixes.
- D. All work within any NCDOT right-of-way shall conform to the requirements of the current version of the NCDOT's Policies and Procedures for Accommodating Utilities on Highway Rights of Way, the provisions and conditions of the encroachment agreement(s), and other applicable NCDOT standards and policies. The encroachment agreement(s) are considered part of the project specifications by reference. Copies of the agreement(s) will be provided upon request from the Architect.

**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 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
1. Use flexible or curved forms for curves with a radius 100 feet or less.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

## 2.3 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
- C. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.
- D. Plain Steel Wire: ASTM A 82, as drawn.
- E. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs. Electroplated zinc, tapered steel plates, ASTM A 108, ASTM B633 with corresponding pocket former are an acceptable alternative to dowel bars.
1. Unless indicated otherwise on the drawings, dowels shall be the following diameter:
    - a. 6-in slabs: 5/8-in diameter dowels.
    - b. 7-in slabs: 1-in diameter dowels.
    - c. 8-in or thicker slabs: 1-1/4-in diameter dowels.
- F. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.
- G. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:
1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

## 2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use one of the following cementitious materials, of the same type, brand, and source throughout the Project:
1. Portland Cement: ASTM C 150, portland cement, Type I, II, or III.
    - a. Fly Ash: ASTM C 618, Class F. Up to 30% by weight of required cement content, with 1.0-lbs Fly Ash per 1-lb of cement replaced.

- b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120 with 1-lb slag per 1-lb of cement replaced.
- B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate, uniformly graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar pavement applications and service conditions using similar aggregates and cementitious materials.
  - 1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
  - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M, potable.
- D. Air-Entraining Admixture: ASTM C 260.
- E. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
  - 1. 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 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

## 2.6 RELATED MATERIALS

- A. Expansion and Isolation Joint Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Wheel Stops: Precast, air-entrained concrete; 2500-psi minimum compressive strength; approximately 6 inches high, 9 inches wide, and 84 inches long. Provide chamfered corners and drainage slots on underside and provide holes for dowel-anchoring to substrate.
  - 1. Dowels: Galvanized steel, diameter of 3/4 inch, minimum length 10 inches.
- C. Slip Resistive Aggregate Finish: Factory-graded, packaged, rustproof, non-glazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- D. Bonding Agent: ASTM C 1059, Acrylic or styrene butadiene.
- E. Epoxy Adhesive: ASTM C 881, two-component material suitable for dry or damp surfaces. Provide material type, grade, and class to suit requirements.

## 2.7 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
  - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
  - 1. Compressive Strength (28 Days): 4,500-psi, 4000 psi, 3500 psi, or 3000 psi as indicated on the drawings.
  - 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: As specified by NCDOT Standard Specifications for class of concrete indicated.
  - 3. Slump Limit: Maximum 3.5 inches for non-vibrated, maximum 4 inches for vibrated.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
  - 1. Air Content: 5-1/2 percent plus or minus 1.5 percent for 1-1/2-inch (38-mm) nominal maximum aggregate size.
  - 2. Air Content: 6 percent plus or minus 1.5 percent for 1-inch (25-mm) nominal maximum aggregate size.
  - 3. Air Content: 6 percent plus or minus 1.5 percent for 3/4-inch (19-mm) nominal maximum aggregate size.
- D. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
  - 1. Use admixtures 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.
- E. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements as follows:
  - 1. Fly Ash: 30 percent.
  - 2. Ground Granulated Blast-Furnace Slag: 50 percent.
  - 3. Combined Fly Ash, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash not exceeding 20 percent.
- F. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

## 2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116. Furnish batch certificates for each batch discharged and used in the Work.
  - 1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
  - 1. For concrete mixes of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
  - 2. For concrete mixes larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.

3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

## 2.9 JOINT SEALANTS

- A. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.
- B. Round Backer Rod for Cold-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depths and pavement bottom-side adhesion of sealant.

## 2.10 PAVEMENT MARKINGS

- A. Parking Lot Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes and formulated for concrete surfaces.

1. Color: As indicated on the drawings.

## PART 3 - EXECUTION

### 3.1 SURFACE PREPARATION

- A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving. Ensure subgrade is graded for proper drainage. Repair as needed to avoid ponding on final pavement surfaces.
- B. Remove loose material from compacted subbase surface immediately before placing concrete.
- C. Herbicide Treatment: Apply chemical weed control agent in strict compliance with manufacturer's recommended dosages and application instructions. Apply to compacted, dry subbase.
- D. Place aggregate base courses as specified in Division 31 Section "Earth Moving".

### 3.2 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for paving to required lines, grades, and elevations. Install forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement. Set forms to ensure positive drainage and compliance with ADA and Building Code requirements.
- B. Check completed formwork and screeds 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 inch 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 PLACING REINFORCEMENT

- A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars" for placing and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire fabric in lengths as long as practicable at mid depth of concrete. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

### 3.4 JOINTS

- A. General: Refer to the project plans and details for additional requirements.
1. Construct contraction, construction, and isolation joints true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to the centerline, unless indicated otherwise.
  2. When joining existing paving, place transverse joints to align with previously placed joints, unless indicated otherwise.
- C. Contraction (Control) Joints: Provide weakened-plane contraction joints, sectioning concrete into areas as indicated below unless shown otherwise on Drawings. Construct contraction joints for a depth equal to 1/4 to 1/3 of the concrete thickness, as follows:
1. Tooled Joints: Form contraction joints in fresh concrete by grooving and finishing each edge of joint with a radiused jointer tool.
  2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into hardened concrete when cutting action will not tear, abrade, or otherwise damage surface and before development of random contraction cracks.
  3. Inserts: Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strips into fresh concrete until top surface of strip is flush with paving surface. Radius each joint edge with a jointer tool. Carefully remove strips or caps of two-piece assemblies after concrete has hardened. Clean groove of loose debris.
  4. Spacing:
    - a. Concrete Pavement (4-in to 4.5-in thick slabs): Locate contraction joints at 10-ft max. intervals, each way in concrete pavement.
    - b. Concrete Pavement (5-in to 5.5-in thick slabs): Locate contraction joints at 12.5-ft max. intervals, each way in concrete pavement.
    - c. Concrete Pavement (6-in and greater thick slabs): Locate contraction joints at 15-ft max. intervals, each way in concrete pavement.
    - d. Sidewalk & Patios (4-in thick slabs): Locate contraction joints at 5-ft max. intervals, each way in concrete sidewalks/patios unless shown otherwise. Locate contraction joints in sidewalks less than 8-ft in width at 5-ft intervals across the walk. Locate contraction joints in sidewalks of 8-ft and greater width at 5-ft intervals across the walk and equally section the walk lengthwise with joints at 5-ft. max. intervals (example: an 8-ft wide walk shall have contraction joints at 5-ft. spacing across the walk and one joint dividing the walk lengthwise into two, equal 4-ft sections.)
    - e. Curbs or Curb & Gutter: Locate contraction joints at 10-ft max. intervals in concrete curbs or concrete curb and gutter.
  5. Dowels: Some concrete pavement applications in very heavy load locations (such as fire stations) require dowels at contraction joints. Refer to the drawings for specific details for such requirements.
- C. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than 1/2 hour, unless paving terminates at isolation joints.
1. Continue reinforcement across construction joints unless indicated otherwise. Do not continue reinforcement through sides of strip paving unless indicated.
  2. Provide tie bars at sides of paving strips where indicated.
  3. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- D. Isolation (expansion) Joints: Form isolation joints of preformed joint filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
1. General spacing: Locate additional expansion joints at the following intervals unless indicated otherwise on the drawings.
    - a. Pavement (greater than 4-in thick slabs): None in addition to located specified above.
    - b. Sidewalks (4-in thick slabs): 30-ft each way.
    - c. Curbs or Curb & Gutter: 90-ft spacing.

2. Extend joint fillers full width and depth of joint 1/2 inch below finished surface where joint sealant is indicated. Place top of joint filler flush with finished concrete surface when no joint sealant is required.
  3. Furnish 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.
  4. Protect top edge of joint filler during concrete placement with a metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- E. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.
1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.
  2. Use pocket formers, installed per manufacturer recommendations, if steel plates are used in-lieu of dowels.

### 3.5 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work. Ensure forms are set to ensure water will not pond on final surface.
- B. Remove snow, ice, or frost from base surface and reinforcing before placing concrete. Do not place concrete on surfaces that are frozen.
- C. Moisten base to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.
- D. Comply with requirements and with ACI 304R for measuring, mixing, transporting, and placing concrete.
- E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- F. Form and pour concrete pavement with thickened edges along all edges that could be subject to vehicle wheel loads, do not abut a building or wall, or are not doweled to the adjacent pavement or structure.
- G. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- H. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete complying with ACI 309R.
1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcing, dowels, and joint devices.
- I. Screed paved surfaces with a straightedge and strike off. Use bull floats or darbies to form a smooth surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces prior to beginning finishing operations.
- J. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.
1. 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.
- K. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete.

1. Spill Gutters: Form and install curb and gutter with gutter pans that spill at ¼" per foot slope away from the curb in the following locations. Do not install curb and gutter that will pond water.
  - a. Outside of the Public Right of Way: Provide spill gutter where curb and gutter is located adjacent to pavement surfaces that slope away from curb.
  - b. Within the Public Right of Way: Slope gutter per NCDOT Standard Drawing 846.01.
- L. Cold-Weather Placement: Comply with provisions of ACI 306R and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  1. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
  2. Do not use frozen materials or materials containing ice or snow.
  3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
- M. Hot-Weather Placement: Place concrete complying with ACI 305R and as specified when hot weather conditions exist.
  1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
  3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

### 3.6 CONCRETE FINISHING

- A. Float Finish: Begin floating when bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Finish surfaces to true planes within a tolerance of 1/4 inch in 10 feet as determined by a 10-foot-long straightedge placed anywhere on the surface in any direction. Cut down high spots and fill low spots to ensure positive drainage and eliminate ponding. Refloat surface immediately to a uniform granular texture.
  1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across all site concrete sidewalk and pavement surfaces perpendicular to line of traffic to provide a uniform fine line texture finish.
- B. Final Tooling: Tool edges of paving, gutters, curbs, and joints formed in fresh concrete with a jointing tool to a radius of ¼-inch unless indicated otherwise on the drawings. Repeat tooling of edges and joints after applying surface finishes. Eliminate tool marks on concrete surfaces.
- C. Step Tread Grooves: Tool three (3) parallel grooves along entire top front edge of new concrete stair treads.

### 3.7 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with the recommendations of ACI 306R for cold weather protection and ACI 305R for hot weather protection during curing.
- B. Evaporation Control: In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before floating.
- C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than 7 days with the following materials:
  - a. Water.
  - b. Continuous water-fog spray.
  - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with a 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. 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 directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

### 3.8 TRAFFIC MARKINGS

- A. Cleaning: Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.
- B. Surface Preparation: Surfaces shall be cured, clean, dry and sound. Remove all peeling paint from existing surfaces. Concrete surfaces shall cure minimum 30 days. Concrete sealers or efflorescence of new concrete should be removed by extended weathering, etching or abrasive blasting.
- C. Application Conditions: 50° min., 90° maximum (air, surface, and materials) at least 5° above dew point. Relative humidity 85% maximum.
- D. Tinting: Mix colors per manufacturer's specification. Only mix like paints (do not mix latex with acrylic or interior paints with exterior paints) to achieve required colors.
- E. Apply traffic paint with mechanical equipment to produce uniform straight edges. Apply at manufacturer's recommended rates to provide minimum 12 to 15 mils dry thickness.

### 3.9 FIELD QUALITY CONTROL TESTING

- A. The Owner shall employ an independent testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement in accordance with Division 01 Section "Quality Control" and as follows:
  1. When total quantity of a given class of concrete is less than 50 cu. yd., Architect may waive strength testing if adequate evidence of satisfactory strength is provided.
  2. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
  1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
  2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
  3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
  5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.

a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within one week of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.10 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective, or does not meet the requirements of this Section.

B. 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 paving with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep concrete paving not more than 2 days prior to date scheduled for Substantial Completion inspections.

E. Remove and replace concrete paving or curb and gutter that ponds water.

END OF SECTION

**SECTION 32 14 00  
UNIT PAVERS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings 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. Brick pavers set in aggregate setting bed.
  - 2. Edge restraints for unit pavers.
- B. Related Sections include the following:
  - 1. Division 31 Section "Earth Moving" for compacted subgrade and subbase course, if any, under unit pavers.
  - 2. Division 32 Section "Concrete Paving" for cast-in-place concrete curbs and gutters serving as edge restraint for unit pavers.

**1.3 SUBMITTALS**

- A. Product Data: For the following:
  - 1. Brick pavers.
  - 2. Aggregate setting materials.
  - 3. Edge restraints.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of unit paver indicated.
- C. Samples for Verification: Full-size units of each type of unit paver indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.
  - 1. Include Samples of exposed edge restraints.
- D. Qualification Data: For firms and persons specified in "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.

**1.4 QUALITY ASSURANCE**

- A. Installer Qualifications: An experienced installer who has completed unit paver installations similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of unit paver, joint material, and setting material from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Protect unit pavers and aggregate during storage and construction against soiling or contamination from earth and other materials.
  - 1. Cover pavers with plastic or use other packaging materials that will prevent rust marks from steel strapping.
- B. Store liquids in tightly closed containers protected from freezing.

## 1.6 PROJECT CONDITIONS

- A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

## PART 2 - PRODUCTS

### 2.1 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, the following:

- 1. Brick Pavers:
  - a. Pine Hall Brick.(Basis of Design)
  - b. Endicott Clay Products Co.
  - c. Glen-Gery Corporation.
  - d. Whitacre-Greer.

### 2.2 COLORS AND TEXTURES

- A. Colors and Textures: Match existing on-site.

### 2.3 UNIT PAVERS

- A. Brick Pavers: Light-traffic paving brick; ASTM C 902, Class SX, Type I, Application PX, ASTM C67 for freeze/thaw. Provide brick without frogs or cores in surfaces exposed to view in the completed Work.

- 1. Basis of Design: English Edge by Pine Hall Brick
- 2. Thickness: 2.25 inches
- 3. Face Size and Shape: 4-inch x 8-inch rectangle
- 4. Brick shall be able to receive custom engraving should the owner decide to pursue an engraving campaign.
- 5. Attic Stock: Contractor shall furnish 20% additional brick pavers beyond what is needed for the paver area shown on the plans to the Owner for their use in a potential engraving campaign and also be utilized if pavers need to be replaced in the future.
- 6. Color: To be selected by Landscape Architect from manufacturer's full range.

### 2.4 ACCESSORIES

- A. Steel Edge Restraints: Painted commercial steel edging with loops pressed from or welded to face to receive stakes at 36 inches (900 mm) o.c., and steel stakes 15 inches (380 mm) long for each loop. Size of edging is as follows:

- 1. 3/16 inch (4.8 mm) thick by 4 inches (100 mm) high.

- B. Job-Built Concrete Edge Restraints: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mixed concrete with minimum 28-day compressive strength of 3000 psi (20 MPa).

### 2.5 AGGREGATE SETTING-BED MATERIALS

- A. Graded Aggregate for Subbase: Aggregate base course material.
- B. Geotextile: Woven or nonwoven geotextile manufactured from polyester or polypropylene fibers, with a permeability rating 10 times greater than that of soil on which paving is founded and an apparent opening size small enough to prevent passage of fines from leveling course into graded aggregate of base course below.
- C. Sand for Leveling Course: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements of ASTM C 33 for fine aggregate.

- D. Sand for Joints: Polymeric sand complying with the requirements in ASTM C144 for ICPI gradation specification for joint sand.
  - 1. Provide color options to landscape architect for selection.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. Where pavers are to be installed over waterproofing, examine waterproofing installation, with waterproofing Installer present, for protection from paving operations. Examine areas where waterproofing system is turned up or flashed against vertical surfaces and horizontal waterproofing. Proceed with installation only after protection is in place.

#### 3.2 PREPARATION

- A. Vacuum clean concrete substrates to remove dirt, dust, debris, and loose particles.
- B. Remove substances, from concrete substrates, that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.
- C. Proof-roll prepared subgrade surface to check for unstable areas and areas requiring additional compaction. Proceed with unit paver installation only after deficient subgrades have been corrected and are ready to receive subbase for unit pavers.

#### 3.3 INSTALLATION, GENERAL

- A. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be visible or cause staining in finished work.
- B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
- C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.
- D. Joint Pattern: Match existing unit paver joint pattern.
- E. Tolerances: Do not exceed 1/32-inch (0.8-mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 10 feet (3 mm in 3 m) from level, or indicated slope, for finished surface of paving.
- F. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.
  - 1. For metal edge restraints with top edge exposed, drive stakes at least 1 inch (25 mm) below top edge.
  - 2. Install job-built concrete edge restraints to comply with requirements in Division 3 Section "Cast-in-Place Concrete."
  - 3. Where pavers embedded in concrete are indicated as edge restraints for pavers set in aggregate setting bed, install pavers embedded in concrete and allow concrete to cure before placing aggregate setting bed and remainder of pavers. Hold top of concrete below aggregate setting bed.
- G. Provide steps made of pavers as indicated. Install paver steps before installing adjacent pavers.
  - 1. Where pavers set in mortar bed are indicated for steps constructed adjacent to pavers set in aggregate setting bed, install steps and allow mortar to cure before placing aggregate setting bed and remainder of pavers. Cut off mortar bed at a steep angle so it will not interfere with aggregate setting bed.

### 3.4 AGGREGATE SETTING-BED PAVER APPLICATIONS

- A. Compact soil subgrade uniformly to at least 95 percent of ASTM D 1557 laboratory density.
- B. Place geotextile over prepared subgrade, overlapping ends and edges at least 12 inches (300 mm).
- C. Place aggregate subbase and base in thickness indicated. Compact by tamping with plate vibrator and screed to depth required to allow setting of pavers.
- D. Place leveling course and screed to a thickness of 1 to 1-1/2 inches (25 to 38 mm), taking care that moisture content remains constant and density is loose and constant until pavers are set and compacted.
- E. Treat leveling base with soil sterilizer to inhibit growth of grass and weeds.
- F. Set pavers with a minimum joint width of 1/16 inch (1.6 mm) and a maximum of 1/8 inch (3 mm), being careful not to disturb leveling base. If pavers have spacer bars, place pavers hand tight against spacer bars. Use string lines to keep straight lines. Fill gaps between units that exceed 3/8 inch (10 mm) with pieces cut to fit from full-size unit pavers.
  - 1. When installation is performed with mechanical equipment, use only unit pavers with spacer bars on sides of each unit.
- G. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf (16- to 22-kN) compaction force at 80 to 90 Hz. Perform at least three passes across paving with vibrator. Vibrate under the following conditions:
  - 1. After edge pavers are installed and there is a completed surface or before surface is exposed to rain.
  - 2. Before ending each day's work, fully compact installed concrete pavers to within 36 inches (900 mm) of the laying face. Cover open layers with nonstaining plastic sheets overlapped 48 inches (1200 mm) on each side of the laying face to protect it from rain.
- H. Joint Sand
  - 1. Sweep or blow off the surface before joint sand installation.
  - 2. Spread dry sand and fill joints immediately after vibrating pavers into leveling course. DO NOT apply this polymeric sand to a wet or damp surface. Make sure paver joints and surface are completely dry AND there is no rain forecasted for at least 12 hours after installation. If there is a possibility of rain shortly after installation, cover project with a tarp. Remove tarp as soon as threat of rain is gone. Covering with a tarp will extend curing time.
  - 3. Polymeric sand should be installed when the average ambient air temperature is above 35 degrees for a minimum of 48 hours after installation. Do not install in rain and turn off irrigation systems.
  - 4. Vibrate pavers and add sand until level is 1/8" below joint surface, then remove excess sand.
  - 5. Using a water hose with nozzle on shower setting, gently mist the pavement no greater than 500 sf at a time. Allow water to absorb into joint for approximately 5 minutes. Repeat misting process 3, up to 4 times, gradually increasing volume of water each time. Do not apply too much water too fast as to flood the pavement or erode sand from paver joints. Weather and site conditions will determine the number of waterings needed to saturate the full joint depth. For optimal joint performance, the entire sand joint must be fully saturated. The last watering should be a volume of water sufficient enough to rinse off any residual material from the surface. Any residual water caught in the texture of the pavement surface should be blown off with a leaf blower.
- I. Do not allow traffic on installed pavers until sand has been vibrated into joints.
- J. Repeat joint-filling process 30 days later.

### 3.5 REPAIR, CLEANING, AND PROTECTION

- A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units as intended. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

END OF SECTION

**SECTION 32 4000  
SITE FURNISHINGS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. This Section includes the following:

1. Benches.
2. Trash receptacles.
3. Outdoor Tables.

**1.2 SUBMITTALS**

- A. Product Data: For each product indicated.
- B. Samples: For each type of exposed finish and for each color and texture required.
- C. Material Certificates: For the following:
1. Recycled plastic.
- D. Maintenance data.

**PART 2 - PRODUCTS**

**2.1 BENCHES**

- A. Bench, With Back & Backless: Streetlife, T: 215-247-0148. [usa@streetlife.com](mailto:usa@streetlife.com)  
Solid-Series, Solid Skirt Crosswise Bench with both backed and backless options. Refer to drawings for bench sizes and locations of back options, or approved equal.
1. Support Frame Material: Galvanized steel.
  2. Seat and Back Material: "Cloudy Grey" wood alternative, made from recycled LDPE and recycled textile fibers.
  3. Backrests: 6-Slat backrest, ADA compliant, model # SOL-L-BR6-180.
  4. Arm Rests: Model # ARM-T. Provide arm rests at 4 locations; coordinate locations with Architect prior to installation.
  5. Installation Method: Surface mounted, as recommended by manufacturer.
- B. Free-Standing Bench: Forms + Surfaces, T: 800-451-0410, [www.forms-surfaces.com](http://www.forms-surfaces.com).  
Flight Bench, model # SBFLT-72BA, 6 foot length, with armrests, or approved equal.
1. Frame: Aluminum.
  2. Slats: Extruded Aluminum.
  3. Finish: Powder coated.
  4. Color: Architect to select from manufacturer's full range.
  5. Installation Method: Surface mounted, as recommended by manufacturer.

**2.2 TRASH RECEPTACLES**

- A. Forms + Surfaces, T: 800-451-0410, [www.forms-surfaces.com](http://www.forms-surfaces.com).  
Tonyo Litter and Recycling Receptacle, model # SLTNO-130S; 30 gal, single-stream. Powder Coated stainless steel body/door, or approved equal.
1. Size: Diameter 23.1 inches.
  2. Height: 47.1 inches.
  3. Finish: Powder coated.
  4. Color: Architect to select from manufacturer's full range.
  5. Installation Method: Surface mounted, as recommended by manufacturer.

**2.5 OUTDOOR TABLES**

- A. Landscape Forms, T: 269-337-1310, Lori Brown: Lorib@landscapeforms.com.  
35 Collection Mingle Table, or approved equal; 2-seat backed, and 4-seat backed tables as indicated on drawings.
  - 1. Material: Cast aluminum frame with powder coated finish.
  - 2. Seat: Backed, stainless steel pans, with Fade perforation pattern.
  - 3. Tops: Catena with powder coated finish, no umbrella holes.
  - 4. Color: Architect to select from manufacturer's full range.
  - 5. Installation Method: Surface mounted, as recommended by manufacturer.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Complete field assembly of site and street furnishings, where required.
- B. Unless otherwise indicated, install site and street furnishings after landscaping and paving have been completed.
- C. Install site and street furnishings level, plumb, true, and securely positioned at locations indicated on Drawings and in accordance with manufacturer's printed instructions.

END OF SECTION

**SECTION 32 84 00**  
**IRRIGATION SYSTEMS PERFORMANCE**

**PART 1 – GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. The work to be done shall include furnishing all plans, all permitting, all labor, materials, equipment and services (includes valves, piping, sleeves, sprinklers, specialties, accessories, control, and wiring for a fully functional irrigation system(s). Work performed shall be as indicated on the drawings, as specified herein; or both.
- B. Design shall be performed by a licensed irrigation designer or contractor.
- C. The point of connection for the irrigation system shall be as determined by the irrigation designer. Backflow prevention and meter shall be provided and shall be considered a part of the irrigation system.
- D. The Drawings and Specifications must be interpreted and are intended to complement each other. The Contractor shall furnish and install all parts, which may be required by the Drawings and omitted by the specifications, or vice versa. Should there appear to be discrepancies or question of intent, the Contractor shall refer the matter to the Owner's Representative for decision, and his interpretation shall be final, conclusive and binding.
- E. All necessary changes to the drawings to avoid any obstacles shall be made by the Contractor with the approval of the Owner's Representative.
- F. Trench excavation, backfilling, reseeding and re-mulching, together with the testing of the completed installation shall be included in this work.
- G. Record drawings shall also be included in this work.

**Section Includes:**

- 1. Piping.
- 2. Manual valves.
- 3. Pressure-reducing valves.
- 4. Automatic control valves.
- 5. Automatic drain valves.
- 6. Transition fittings.
- 7. Miscellaneous piping specialties.
- 8. Controllers.
- 9. Boxes for automatic control valves.

**1.3 DEFINITIONS**

- A. Pipe sizes used in this Section are nominal pipe size (NPS) in inches. Tube sizes are Standard size in inches.
- B. Supply Piping: Piping from water source to connection to irrigation system pressure piping. Piping is under same pressure as water supply. Piping in this category is not included in this Section
- C. Pressure Piping: Piping downstream from supply piping to and including control valves. Piping is under irrigation system pressure. Piping in this category includes pressure regulators, water meters, and backflow preventers, when used.

- D. Circuit Piping: Piping downstream from control valves to irrigation system sprinklers, emitters, deices, and drain valves. Piping is under pressure (less than pressure piping) during flow.
- E. Control Valve: Manual or automatic (electrically operated) valve for control water flow to irrigation system zone.
- F. Drain Piping: Downstream from circuit piping drain valves. Piping is not under pressure.
- G. Drain Valve: Manual or automatic (pressure operated) drain valve for draining of irrigation system circuit piping.
- H. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

#### 1.4 PROJECT DESIGN PARAMETERS

- A. Irrigation system layout shall be diagrammatic. Exact locations of piping, , valves, and other components shall be established by Contractor and the Irrigation Designer in the field at time of installation. Design irrigation to provide minimum working psi at base of sprinkler head.
- B. Minor adjustments in system layout will be permitted to clear existing fixed obstructions. Final system layout shall be acceptable to the Irrigation Designer.
- C. Cutting and patching:
  - 1. No open cuts permitted.

#### 1.5 PERFORMANCE REQUIREMENTS

- A. Irrigation zone control shall be automatic operation with controller and automatic control valves.
- B. Delegated Design: Design 100 percent irrigation system(s), including comprehensive design analysis by a certified irrigation designer, using performance requirements and design criteria indicated.
  - 1. Water Source: Public water system, as shown on civil drawings. Connect to existing water main. Exact location to be determined by owner and public utility provider. System shall include all necessary connections, controls, and appurtenances.
  - 2. Pressure Source: Design shall include pump(s) as necessary to provide pressure and flow necessary for full operation irrigation system. Field verify water pressure at time of installation to determine if pump is necessary.
  - 3. Irrigation Area: See the Irrigation Performance Plan. System shall be designed to apply irrigation to each area within the designated irrigation area.
  - 4. Irrigation Rate: System shall be designed to apply approximately 1-in depth of irrigation per week over entire irrigation area under a normal operating schedule.
- C. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties unless otherwise indicated:
  - 1. Irrigation Main Pressure Piping: 200 psig (1380 kPa).
  - 2. Circuit and Drain Piping: 150 psig (1035 kPa).
- D. Irrigation zone control shall be automatic operation with controller and automatic control valves.
- E. All control wire shall be #14 gauge, single strand, red for turf zones, all common wire shall be #12 gauge single strand white and all spare wires, installed where shown, shall be #14 gauge single strand blue.

#### 1.6 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical

characteristics, and furnished specialties and accessories.

- B. Wiring Diagrams: For power, signal, and control wiring.
- C. Delegated-Design Submittal: For irrigation systems, an Irrigation Plan, to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified, certified irrigation designer responsible for their preparation. Irrigation plan shall be permitted by the contractor through Pender County.
- D. Coordination Drawings: Irrigation systems, drawn to scale, on which components are shown and coordinated with each other, using input from Installers of the items involved. Also include adjustments necessary to avoid plantings and obstructions such as signs and light standards.
- E. Qualification Data: For qualified Installer.
- F. Zoning Chart: Show each irrigation zone and its control valve.
- G. Controller Timing Schedule: Indicate timing settings for each automatic controller zone.
- H. Field quality-control reports.

#### 1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For sprinklers controllers, automatic control valves and pumps to include in operation and maintenance manuals.

#### 1.8 QUALITY ASSURANCE

- A. Comply with requirements of utility supplying water for prevention of backflow and back-siphonage. Coordinate with Pender County Utilities for location of backflow preventer.
- B. Comply with requirements of authority with jurisdiction for irrigation systems.
- C. Installer Qualifications: An employer of workers that include a certified irrigation designer qualified by The Irrigation Association, a Professional Class member of the American Society of Irrigation Consultants or a Professional Technical Class member of the American Society of Irrigation Consultants.
- D. Listing/Approval Stamp, Label, or Other Marking: On equipment, specialties, and accessories made to specified standards.
- E. Listing and Labeling: Equipment, specialties, and accessories that are listed and labeled.
  - 1. The Terms "Listed" and "Labeled": As defined in "National Electrical Code," Article 100.
  - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

#### 1.9 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Verify that irrigation system piping may be installed in compliance with original design and referenced standards.

#### 1.10 SEQUENCING AND SCHEDULING

- A. Maintain uninterrupted water service to building during normal working hours if applicable. Arrange for temporary water shutoff with Owner.
- B. General Contractor shall be project coordinator and scheduler.

### 1.11 DELIVERY, STORAGE, AND HANDLING

- A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

## PART 2 - PRODUCTS

### 2.1 PIPES, TUBES, AND FITTINGS

- A. Comply with requirements in the piping schedule for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes per the irrigation system design.
- B. PE Pipe with Controlled ID: ASTM F 771, PE 3408 compound; SDR 11.5 and SDR 15.
  - 1. Insert Fittings for PE Pipe: ASTM D 2609, nylon or propylene plastic with barbed ends. Include bands or other fasteners.
- C. PE Pipe with Controlled OD: ASTM F 771, PE 3408 compound, SDR 11.
  - 1. PE Butt, Heat-Fusion Fittings: ASTM D 3261.
  - 2. PE Socket-Type Fittings: ASTM D 2683.
- D. PE Pressure Pipe: AWWA C906, with DR of 7.3, 9, or 9.3 and PE compound number required to give pressure rating not less than 200 psig (1380 kPa).
  - 1. PE Butt, Heat-Fusion Fittings: ASTM D 3261.
  - 2. PE Socket-Type Fittings: ASTM D 2683.
- E. PVC Pipe: ASTM D 1785, PVC 1120 compound, Schedules 40 and 80.
  - 1. PVC Socket Fittings: ASTM D 2466, Schedules 40 and 80.
  - 2. PVC Threaded Fittings: ASTM D 2464, Schedule 80.
  - 3. PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket ends.
- F. PVC Pipe, Pressure Rated: ASTM D 2241, PVC 1120 compound, SDR 21.
  - 1. PVC Socket Fittings: ASTM D 2467, Schedule 80.
  - 2. PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket or threaded ends.

### 2.2 PIPING JOINING MATERIALS

- A. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
- B. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

### 2.3 MANUAL VALVES

- A. Bronze Ball Valves:

- 1. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig (1035 kPa).
- c. CWP Rating: 600 psig (4140 kPa).
- d. Body Design: Two piece.
- e. Body Material: Bronze.
- f. Ends: Threaded or solder joint if indicated.
- g. Seats: PTFE or TFE.
- h. Stem: Bronze.
- i. Ball: Chrome-plated brass.
- j. Port: Full [or regular, but not reduced].

B. Plastic Ball Valves:

- 1. Description:
  - a. Standard: MSS SP-122.
  - b. Pressure Rating: 125 psig (860 kPa) minimum.
  - c. Body Material: PVC.
  - d. Type: Union.
  - e. End Connections: Socket or threaded.
  - f. Port: Full.

C. Bronze Gate Valves:

- 1. Description:
  - a. Standard: MSS SP-80, Type 2.
  - b. Class: 125.
  - c. CWP Rating: 200 psig (1380 kPa).
  - d. Body Material: ASTM B 62 bronze with integral seat and screw-in bonnet.
  - e. Ends: Threaded or solder joint.
  - f. Stem: Bronze, nonrising.
  - g. Disc: Solid wedge; bronze.
  - h. Packing: Asbestos free.
  - i. Handwheel: Malleable iron, bronze, or aluminum.

## 2.4 PRESSURE-REDUCING VALVES

A. Water Regulators:

- 1. Description:
  - a. Standard: ASSE 1003.
  - b. Body Material: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).
  - c. Pressure Rating: Initial pressure of 150 psig (1035 kPa).
  - d. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).

## 2.5 AUTOMATIC CONTROL VALVES

A. Bronze, Automatic Control Valves:

- 1. Description: Cast-bronze body, normally closed, diaphragm type with manual-flow adjustment, and

operated by 24-V ac solenoid.

## 2.6 AUTOMATIC DRAIN VALVES

- A. Description: Spring-loaded-ball type of corrosion-resistant construction and designed to open for drainage if line pressure drops below 2-1/2 to 3 psig (17 to 20 kPa).

## 2.7 TRANSITION FITTINGS

- A. General Requirements: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
- B. Transition Couplings:
  - 1. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.
- C. Plastic-to-Metal Transition Fittings:
  - 1. Description: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-socket or threaded end.
- D. Plastic-to-Metal Transition Unions:
  - 1. Description: MSS SP-107, PVC four-part union. Include one brass or stainless-steel threaded end, one solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.

## 2.8 CONTROLLERS

- 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. Hunter Industries Incorporated (Basis of Design).
  - 2. Nelson, L. R. Corporation.
  - 3. Rain Bird Corporation.
  - 4. Toro Company (The); Irrigation Division.
- B. Description:
  - 1. Controller Stations for Automatic Control Valves: Include switch for manual or automatic operation of each station.
  - 2. Interior Control Enclosures: NEMA 250, Type 1, general-purpose enclosure with locking cover and two matching keys; include provision for grounding.
    - a. Body Material: Painted or powder-coated steel sheet metal (or stainless steel if required for corrosion resistance or matching equipment).
    - b. Mounting: Wall-mounted or floor-mounted type, suitable for interior installation in control room environment.
  - 3. Control Transformer: 24-V secondary, with primary fuse.
  - 4. Timing Device: Adjustable, 24-hour, 14-day clock, with automatic operations to skip operation any day in timer period, to operate every other day, or to operate two or more times daily.
    - a. Manual or Semiautomatic Operation: Allows this mode without disturbing preset automatic operation.

- b. Nickel-Cadmium Battery and Trickle Charger: Automatically powers timing device during power outages.
  - c. Surge Protection: Metal-oxide-varistor type on each station and primary power.
- 5. Location: As determined by owner.
- 6. Moisture Sensor: Adjustable from one to seven days, to shut off water flow during rain.
- 7. Wiring: UL 493, Type UF multiconductor, with solid-copper conductors; insulated cable; suitable for direct burial.
  - a. Feeder-Circuit Cables: No. 12 AWG minimum, between building and controllers.
  - b. Low-Voltage, Branch-Circuit Cables: No. 14 AWG minimum, between controllers and automatic control valves; color-coded different from feeder-circuit-cable jacket color; with jackets of different colors for multiple-cable installation in same trench.
  - c. Splicing Materials: Manufacturer's packaged kit consisting of insulating, spring-type connector or crimped joint and epoxy resin moisture seal; suitable for direct burial.

## 2.9 BOXES FOR AUTOMATIC CONTROL VALVES

- A. Plastic Boxes:
  - 1. Description: Box and cover, with open bottom and openings for piping; designed for installing flush with grade.
    - a. Size: As required for valves and service.
    - b. Sidewall Material: PE, ABS, or FRP.
    - c. Cover Material: PE, ABS, or FRP.
      - 1) Lettering: "IRRIGATION."
- B. Drainage Backfill: Cleaned gravel or crushed stone, graded from 3/4 inch (19 mm) minimum to 3 inches (75 mm) maximum.

## 2.10 DRIP IRRIGATION SPECIALTIES

- A. Freestanding Emitters: Device to deliver water at approximately 20 psig (138 kPa).
  - 1. Body Material: PE or vinyl, with flow control.
  - 2. Riser to Emitter: PE or PVC flexible tubing.
  - 3. Capacities and Characteristics:
    - a. Flow: As required by design.
    - b. Tubing: PE or PVC; 1/8-inch (3-mm) minimum ID.
    - c. Mounting Height: As specified by design.
- B. Manifold Emitter Systems: Manifold with tubing and emitters.
  - 1. Manifold: With multiple outlets to deliver water to emitters.
    - a. Body Material: Plastic.
    - b. Outlet Caps: Plastic, for outlets without installed tubing.
    - c. Operation: Automatic pressure compensating.
  - 2. Tubing: PE or PVC; 1/8-inch (3-mm) minimum ID.
  - 3. Emitter: Device to deliver water at approximately 20 psig (138 kPa).

- a. Body Material: PE or vinyl, with flow control.
- 4. Capacities and Characteristics:
  - a. Manifold:
    - 1) Design Flow: As required by design.
    - 2) Number of Outlets: As specified by design.
- C. Multiple-Outlet Emitter Systems: Emitter with tubing and button-type outlets.
  - 1. Emitter: With multiple outlets to deliver water to remote outlets.
    - a. Body Material: Plastic, with flow control.
    - b. Outlet Caps: Plastic, for outlets without installed tubing.
    - c. Operation: Automatic pressure compensating.
    - d. Emitters: Devices to deliver water at approximately 20 psig (138 kPa.)
  - 2. Tubing: PE or PVC; 1/8-inch (3-mm) minimum ID.
- D. Drip Tubes with Direct-Attached Emitters:
  - 1. Tubing: Flexible PE or PVC with plugged end.
  - 2. Emitters: Devices to deliver water at approximately 20 psig (138 kPa).
    - a. Body Material: PE or vinyl, with flow control.
    - b. Mounting: Inserted into tubing at set intervals.
- E. Drip Tubes with Remote Discharge:
  - 1. Tubing: Flexible PE or PVC with plugged end.
  - 2. Emitters: Devices to deliver water at approximately 20 psig (138 kPa).
    - a. Body Material: PE or vinyl, with flow control.
    - b. Mounting: Inserted into tubing at set intervals.
- F. Off-Ground Supports: Plastic stakes.
- G. Application Pressure Regulators: Brass or plastic housing, NPS 3/4 (DN 20), with corrosion-resistant internal parts; capable of controlling outlet pressure to approximately 20 psig (138 kPa).
- H. Filter Units: Brass or plastic housing, with corrosion-resistant internal parts; of size and capacity required for devices downstream from unit.
- I. Air Relief Valves: Brass or plastic housing, with corrosion-resistant internal parts.
- J. Vacuum Relief Valves: Brass or plastic housing, with corrosion-resistant internal parts.

## PART 3 - EXECUTION

### 3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."
- B. Install warning tape directly above pressure piping, 12 inches (300 mm) below finished grades, except 6

inches (150 mm) below subgrade under pavement and slabs.

- C. Drain Pockets: Excavate to sizes required by system design. Backfill with cleaned gravel or crushed stone, graded from 3/4 to 3 inches (19 to 75 mm), to 12 inches (300 mm) below grade. Cover gravel or crushed stone with sheet of asphalt-saturated felt and backfill remainder with excavated material.
- D. Provide minimum cover over top of underground piping according to the following:
  - 1. Irrigation Main Piping: Minimum depth of not less than 18 inches (450 mm) below average local frost depth.
  - 2. Circuit Piping: 12 inches (300 mm).
  - 3. Drain Piping: 12 inches (300 mm).
  - 4. Sleeves: 24 inches (600 mm).

### 3.2 PREPARATION

- A. Set stakes to identify locations of proposed irrigation system. Obtain Architect's approval before excavation.

### 3.3 PIPING INSTALLATION

- A. Location and Arrangement: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved on Coordination Drawings.
- B. Install piping at minimum uniform slope of 0.5 percent down toward drain valves.
- C. Install piping free of sags and bends.
- D. Install groups of pipes parallel to each other, spaced to permit valve servicing.
- E. Install fittings for changes in direction and branch connections.
- F. Install unions adjacent to valves and to final connections to other components with NPS 2 (DN 50) or smaller pipe connection.
- G. Install flanges adjacent to valves and to final connections to other components with NPS 2-1/2 (DN 65) or larger pipe connection.
- H. Install expansion loops in control-valve boxes for plastic piping.
- I. Lay piping on solid subbase, uniformly sloped without humps or depressions.
- J. Install PVC piping in dry weather when temperature is above 40 deg F (5 deg C). Allow joints to cure at least 24 hours at temperatures above 40 deg F (5 deg C) before testing.
- K. Install piping in sleeves under parking lots, roadways, and sidewalks.
- L. Install sleeves made of Schedule 80 PVC pipe and socket fittings, and solvent-cemented joints.

### 3.4 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. PE Piping Fastener Joints: Join with insert fittings and bands or fasteners according to piping manufacturer's written instructions.
- E. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
  - 1. Plain-End PE Pipe and Fittings: Use butt fusion.
  - 2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.
- F. PVC Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. PVC Pressure Piping: Join schedule number, ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
  - 3. PVC Non-pressure Piping: Join according to ASTM D 2855.

### 3.5 VALVE INSTALLATION

- A. Pressure-Reducing Valves: Install in boxes for automatic control valves or aboveground between shutoff valves.
- B. Throttling Valves: Install in underground piping in boxes for automatic control valves.
- C. Drain Valves: Install in underground piping in boxes for automatic control valves.

### 3.6 AUTOMATIC IRRIGATION-CONTROL SYSTEM INSTALLATION

- A. Equipment Mounting: Install irrigation controllers on wall supports in control room designated by Owner and Architect..
  - 1. Secure equipment using manufacturer-recommended methods appropriate for interior installations.
  - 2. Use templates, diagrams, and installation instructions provided by the manufacturer to ensure correct placement and alignment.
  - 3. Anchor equipment to wall at heights and locations suitable for operation, accessibility, and maintenance.
- B. Control Cable Installation: Install control cables in conduit routed through walls, ceilings, or under raised floors within the control room and adjacent spaces.
  - 1. Private conductors no smaller than those recommended by the controller manufacturer.
  - 2. Use separate conduit or dedicated cable trays for control wiring to avoid interference with power circuits.
  - 3. Label cables clearly at terminations and junction points for ease of identification and future maintenance.

### 3.7 CONNECTIONS

- A. Install piping adjacent to equipment, valves, and devices to allow service and maintenance.
- B. Connect wiring between controllers and automatic control valves.

### 3.8 IDENTIFICATION

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplates and signs on each automatic controller.
  - 1. Text: In addition to identifying unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

### 3.9 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Any irrigation product will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

### 3.10 STARTUP SERVICE

- A. Perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.
  - 2. Verify that controllers are installed and connected according to the Contract Documents.
  - 3. Verify that electrical wiring installation complies with manufacturer's submittal.

### 3.11 CLEANING AND ADJUSTING

- A. Flush dirt and debris from piping before installing sprinklers and other devices.
- B. Adjust settings of automatic control valves in cooperation with irrigation controller installer.
- C. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.
- D. Adjust devices, except those intended to be mounted aboveground, so they will be flush with, or not more than 1/2 inch (13 mm) above, finish grade.

### 3.12 DEMONSTRATION

- A. Demonstrate to Landscape Architect and Owner that system meets coverage requirements.

- B. Demonstrate to Owner's maintenance personnel operation of equipment, sprinklers, specialties, and accessories. Review operating and maintenance information.
- C. Provide 7 days' written notice in advance of demonstration.

END OF SECTION 328400

**SECTION 32 90 00  
PLANTING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings 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. Trees.
2. Shrubs.
3. Seeded lawns, sod and "no-mow" areas.
4. Topsoil and soil amendments.
5. Planter Soil
6. Fertilizers and mulches.
7. Stakes and guys.
8. Landscape edging.
9. Maintenance, guarantees and warranties.

- B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 31, Section "Site Clearing" for protection of existing trees and planting, topsoil stripping and stockpiling, and site clearing.
2. Division 31, Section "Earth Moving" for excavation, filling, rough grading, and subsurface aggregate drainage and drainage backfill.
3. Division 31 Section "Erosion Controls" soil erosion and sedimentation control.

**1.3 INDUSTRY STANDARDS**

- A. References: Some products and execution are specified in this Section by reference to published specifications or standards of the following:

The American Society for Testing and Materials (ASTM)  
American Association of Nurserymen (AAN)  
US Department of Agriculture (USDA)  
NC Department of Agriculture (NCDA)  
NC Composting Council (NCCC)

- B. Landscape Contractor shall mean a registered "Landscape Contractor" as defined by the NC General Statute 89D ([www.ncclcb.com](http://www.ncclcb.com)). Unless proper credentials and evidence of experience can be supplied to prove equal capabilities, only a Landscape Contractor licensed in the State of NC shall be permitted to perform the work.

1. The Landscape Contractor's performance shall conform to the requirements in the most current edition of the NC Landscape Contractors Manual (NCLCM) as approved by the NC Board of Landscape Contractors. In the event the Landscape Contractor feels there is discrepancy between the NCLCM and the requirements of this Contract that could affect the quality of work; it is the Contractor's responsibility to apprise the Owner and Landscape Architect of the issue.

**1.4 SUBMITTALS**

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specification Sections.
- B. Product certificates signed by manufacturers certifying that their products comply with specified requirements.
1. Manufacturer's certified analysis for standard products.

2. Label data substantiating that plants, trees, shrubs, and planting materials comply with specified requirements.
- C. 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.
- D. Samples of each of the following:
  - 1 Sample of imported mulch (1) 1-gal. sized bag.
  - 2 Topsoil (1) 1-gal sized bag.
- 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, at least fifteen names and address of architects and owners, total years of experience and landscape contractor's license number. If the landscape contractor hires a sub-contractor for seeding operations, the same references shall be required from them also.
- F. Material test reports from qualified independent testing agency indicating and interpreting test results relative to compliance of the following materials with requirements indicated.
  1. Analysis of existing topsoil and suitability as a medium for growing specified lawn. Include recommendations of amendments required to make existing topsoil suitable as a growing medium for specified lawn, if required.
  2. Analysis of imported topsoil, if required due to unacceptability of existing topsoil to meet acceptable growing medium requirements for lawn.
- G. Planting schedule indicating anticipated dates and locations for each type of planting.
- H. Maintenance instructions recommending procedures to be established by Owner for maintenance of landscaping during an entire year. Submit before expiration of required maintenance periods.
- I. Landscape plant schedule, per Article 1.4, A, C, indicating quantity, botanical name, common name, specified size and vendor source for each individual plant species; including any substitutions. Include all cultivars and varieties for substitutions. Provide vendor source contact information as attachment to schedule.
 

CLH Design and the Owner reserve the right to reject any substitution requests and may request that the landscape contractor provide additional vendor search information and/or complete documentation to prove a hardship, to confirm reason(s) for substitution or to prove that the material is not available from local and national nurseries.

Refer to section 1.6, C for information regarding the appropriate time to dig trees. It is the Contractor's responsibility to plan ahead of time rather than waiting and checking availability at the time of installation.
- J. All sod shall be from a certified sod producer and be blue tag certified in accordance with NCCIA and AOSCA.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful landscape establishment.
  1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on the Project site during times that landscaping is in progress.
- B. Testing Agency Qualifications: To qualify for acceptance, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

- C. Provide quality, size, genus, species, and variety of trees and shrubs indicated, complying with applicable requirements of ANSI Z60.1 "American Standard for Nursery Stock."
  - 1. Contractor shall show proof of cultivar authenticity to Landscape Architect. When cultivars are specified, standard species will not be acceptable.
- D. Topsoil Analysis: Furnish a soil analysis made by a qualified independent soil-testing agency stating percentages of organic matter, inorganic matter (silt, clay, and sand), deleterious material, pH, and mineral and plant-nutrient content of topsoil.
  - 1. Report suitability of on-site topsoil for growth of applicable planting material. State recommended quantities of nitrogen, phosphorus, and potash nutrients and any limestone, aluminum sulfate, or other soil amendments to be added to produce a satisfactory topsoil at no additional cost to owner.
- E. Measurements: Measure trees and shrubs according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches (150 mm) above ground for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.
 

When size ranges are given, 50 % of plant material shall be at the larger size.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 01 Section "Project Meetings."

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.
- B. Seed: Deliver seed in original sealed, labeled, and undamaged containers.
- C. Trees and Shrubs: Deliver freshly dug trees and shrubs. Do not prune before delivery, except as approved by Landscape Architect. 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 natural shape. Provide protective covering during delivery. Do not drop trees and shrubs during delivery. For trees which cannot be dug in the summer, Contractor shall have trees pre-dug and heeled-in at the nursery where they are grown until planting. Contractor shall be responsible for ensuring that the trees have been adequately watered and cared for at the nursery prior to delivery. No substitutions will be allowed for trees which cannot be "summer-dug".
- D. Handle balled and burlap stock by the root ball.
- E. Deliver trees, shrubs, and ground covers after preparations for planting have been completed and install immediately. If planting is delayed more than 6 hours after delivery, set planting materials in shade, protect from weather and mechanical damage, and keep roots moist.

PLANT MATERIAL SHALL NOT BE DELIVERED TO THE SITE MORE THAN 72 HOURS BEFORE PLANTING TAKES PLACE. THE LANDSCAPE ARCHITECT RESERVES THE RIGHT TO REJECT ALL MATERIAL NOT PLANTED WITHIN THAT TIME PERIOD UNLESS THE LANDSCAPE CONTRACTOR MAKES HEELING-IN AND IRRIGATION PROVISIONS WITHIN 24 HOURS OF PLANT DELIVERY.

- 1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
- 2. Do not remove container-grown stock from containers before time of planting.
- 3. Water root systems of trees and shrubs stored on site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

#### 1.7 PROJECT CONDITIONS

- A. Utilities: Determine location of above grade and underground utilities and perform work in a manner which will avoid damage. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned.

- B. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Landscape Architect before planting.

#### 1.8 COORDINATION AND SCHEDULING

- A. Coordinate installation of planting materials during normal planting seasons for each type of plant material required.

Planting Season: The normal season for planting balled and burlap material is November 15 through March 15. The normal season for planting container grown material is September 15 through April 15. After notification to proceed, planting operations shall be conducted under favorable weather conditions during the normal planting season. The Landscape Contractor shall make provisions for watering the material on an as-needed basis and as frequently as is required to ensure that plant material thrives.

The General Contractor shall coordinate the planting schedule with the Landscape Contractor to avoid any summer digging and planting.

The Landscape Architect shall be notified and must approve of any schedule changes which may require summer planting. THE CONTRACTOR SHALL NOT BE COMPENSATED FOR ADDITIONAL WATERING COSTS FOR PLANTINGS WHICH ARE INSTALLED IN THE SUMMER.

- B. Temporary Seeding: In accordance with the schedule as detailed on the drawings.
  - 1. In the event the Landscape Contractor is required to establish a temporary seeding cover due to the construction schedule, the Landscape Contractor is not relieved from providing the specified permanent seed mixture.
  - 2. The Landscape Contractor is responsible for eradicating any temporary seed cover by means of mowing, thatching and using an herbicide approved by the Owner's representative at the manufacturer's recommended rate.

#### 1.9 GRASS ESTABLISHMENT SCHEDULE

- A. Refer to the Supplementary Conditions for Final Completion dates of grassed areas of the site.
- B. Definitions:
  - 1. Final Complete seeded or sprigged grass: A healthy, dense, weed free stand of the specified species of grass with 95% grass coverage as evaluated on a per square yard sample basis.
  - 2. Final Complete sodded grass: An installed and rolled healthy sod, free of weeds and dead spots.
- D. Complete Site: A complete installation of grass sod and/or stand of grass, germinated from seed or sprigs, on the complete site shall be established by the following date:
  - 1. Complete Site (Seed, Sprig or Sod) Final Completion: *See Final Completion Date noted in contract documents.* Due to seasonal restrictions the specified date shall not be extended. Extension to the Contract Time will not change this date.

#### 1.10 WARRANTY

- A. General Warranty: The 12-month 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. 12-Month Warranty: Contractor is responsible for general maintenance and care for trees, shrubs, ground covers and ornamental grasses during 12-month warranty period, in addition to general maintenance specified in this Article. Additional maintenance during 12-month warranty period for lawn, grass and sod is not required once areas have met 95% coverage, have met final acceptance and the Owner has

assumed mowing/maintenance of these areas. Contractor agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:
  - a. Death and unsatisfactory growth; except for defects resulting from abuse or incidents that are beyond Contractor's control.
  - b. Structural failures including plantings falling or blowing over.
2. Warranty Periods from Date of Final Completion:
  - a. Trees, Shrubs, Ground Covers, and Ornamental Grasses,: 12 months.
  - b. Lawn, grass and sod (herbicide and fertilizer): 12 months
3. Include the following remedial actions as a minimum:
  - a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
  - b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
  - c. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
  - d. Provide extended warranty for period equal to original warranty period, for replaced plant material.
4. Areas seeded or sodded that are bare and not established at the end of the warranty period shall be re-seeded or re-sodded at no additional cost to the Owner.
5. Contractor is responsible for applying weed control herbicide and fertilizers during warranty period.

#### 1.11 TREE AND SHRUB MAINTENANCE

- A. Maintain trees and shrubs by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free of insects and disease. The presence of significant insects or disease at the end of the 12-month warranty period shall be grounds for rejection of material. Restore or replace damaged tree wrappings. Maintain trees and shrubs until end of the 12-month warranty period.

#### 1.12 LAWN/GRASS MAINTENANCE

- A. Begin maintenance of lawns and other grassed/sodded areas immediately after each area is planted and continue until acceptable lawn is established and accepted by the Owner, but for not less than the following periods:
  1. Seeded Lawns/Grass and Naturalized Seed Areas: **Final Completion.**
    - a. When full maintenance period has not elapsed before end of planting/growing season, or if lawn is not fully established at that time (95% coverage as established on a per square yard sample basis), continue maintenance during next planting season until 95% coverage is established.
  2. Sodded Lawns/Grass: **Final Completion.**
    - a. Sodded areas will be accepted at final inspection if –
      1. Sodded areas are properly established.
      2. Sod is free of bare and dead spots and without weeds.
      3. Sodded areas have been mowed a minimum of twice.

- B. Maintain and establish lawns by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and re-mulch to produce a uniformly smooth lawn.
- C. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawns uniformly moist to a depth of 4 inches (100 mm). Following the date of project Final Completion, water shall be provided by contractor own water source (water truck, gator bag, etc.).
  - 1. Supplement natural precipitation to provide a net rate of one inch of water per week or as required to maintain lawn in a thriving condition.
  - 2. Watering shall conform to the time, volume and frequency recommendations of applicable governmental water conservation regulations.
  - 3. Irrigate at minimum rate of once per day for two full weeks following date of seeding or sod installation.
  - 4. Irrigate at minimum of once per week for remainder of maintenance period.
- D. Mow lawns as soon as there is enough top growth to cut with mower set at specified height for principal species planted. Repeat mowing as required to maintain specified height without cutting more than 40 percent of the grass height at any mowing. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet.
- E. Postfertilization: Apply fertilizer to lawn after first mowing and when grass is dry. Apply only from August through October.
  - 1. Use fertilizer that will provide actual nitrogen of at least 1 lb per 1000 sq. ft. (0.5 kg per 100 sq. m) of lawn area or as required to maintain lawn in a thriving condition. A minimum of 50% of the nitrogen shall be in a slow release form.

#### 1.13 STORMWATER CONTROL MEASURE MAINTENANCE

- A. Begin maintenance of stormwater control measures (stormwater wetlands, detention ponds and bioretention cells) immediately after each area is planted, and continue until final acceptance by the Authority Having Jurisdiction (AHJ) but for no less than the 12-month warranty period.
- B. The area to be maintained shall include the wet and dry surfaces of the facility and perimeter areas within 15-ft of the water quality pool elevation, along with the inlet and outlet structures, embankments, emergency spillway, turf and plants.
  - 1. Maintenance shall include all items listed in the Operation & Maintenance Plan listed on the drawings. Maintenance shall include, but not limited to, the following:
    - a. Keep dry and wet areas clean of trash and debris.
    - b. Repair of erosion. Re-seed any bare areas including top and slopes of embankments.
    - c. Keep inlet and outlet pipes, weirs, orifices, under-drains, and swales clear of blockages.
    - d. Remove accumulated sediment from riprap aprons.
    - e. Remove accumulated sediment forebay of wetlands and ponds if greater than 12-in of accumulation.
    - f. Prune shelf plants.
    - g. Remove invasive plants and algae.
    - h. Replace dead plants.
    - i. Replace/replenish mulch.
    - j. Other requirements of the Operation and Maintenance Plan on the drawings.
  - 2. Perform inspections at least every two months and after every storm of greater than 1.5-in of rainfall. Perform maintenance as needed.
  - 3. Final maintenance shall be performed immediately prior to the 11-month inspection.
  - 4. Perform additional maintenance and repair resulting from the 11-month inspection.
  - 5. Records of inspections and maintenance performed shall documented and supplied to the Owner at the completion of the warranty and maintenance period.

## PART 2 - PRODUCTS

## 2.1 TREE AND SHRUB MATERIAL

- A. General: Furnish nursery-grown trees and shrubs conforming to 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, including trunks which are not straight on single stem trees.
- B. The natural stem/root collar of balled and burlap materials shall be found within two inches of the nursery maintained soil line. Trees shall not be accepted which have been grown too deeply or too high in the soil profile.
- C. Grade: Provide trees and shrubs of sizes and grades conforming to ANSI Z60.1 for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Landscape Architect, with a proportionate increase in size of roots or balls.
- D. Label one tree and shrub in each plant grouping with securely attached, waterproof tag bearing legible designation of botanical and common name. Proof of cultivar shall be required on all species for which a cultivar is designated.
- E. Label at least 1 tree and 1 shrub of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.
- F. Imported Fire Ant Control: All plants shall be accompanied by a certificate stating: "certified under all applicable state and federal quarantine." Contact Landscape Architect for inspection of all plant materials for the presence of imported fire ants. The presence of fire ants shall be cause for rejection of plant material.

## 2.2 SHADE AND FLOWERING TREES

- A. Shade Trees: Single-stem trees with straight trunk, free of basal sprouts, well-balanced crown, and intact leader, of height and caliper indicated, conforming to ANSI Z60.1 for type of trees required. Grounds for rejection may include, but not limited to: improper branch density or distribution, "v" crotches, including bark, undesirable multiple leaders, leaders that have been topped or headed back, prevalent suckering or epicormic sprouting. Trees which have evidence of unevenly distributed, girdling or suckering roots may be rejected.
  - 1. Branching Height: 1/2 of tree height.
- B. Small Trees: Small upright or spreading type, branched or pruned naturally according to species and type, and with relationship of caliper, height, and branching recommended by ANSI Z60.1, and stem form as specified in the Plant List on the drawings. Good structure shall be especially critical for trees. Grounds for rejection may include, but not limited to: improper branch density or distribution, "v" crotches, including bark, undesirable multiple leaders, leaders that have been topped or headed back, prevalent suckering or epicormic sprouting. Trees which have evidence of unevenly distributed, girdling or suckering roots may be rejected.
- C. Provide balled and burlap trees unless noted otherwise on the drawings. Plants designated "B&B" in the plant list shall be balled and burlap. They shall be nursery grown and freshly dug. They shall be dug with firm, natural balls of earth of sufficient diameter and depth to encompass the fibrous and feeding root system necessary for full recovery of the plant. Balls shall be firmly wrapped with untreated biodegradable burlap and bound with twine, cord, or wire mesh basket. Plants shall not be accepted if the ball is dry, deformed or broken before or during the planting operations.

## 2.3 DECIDUOUS SHRUBS

- A. Form and Size: Deciduous shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape, and height of shrub.
- B. Provide container grown shrubs unless noted otherwise on the drawings.

## 2.4 CONIFEROUS EVERGREENS

- A. Form and Size: Specimen-quality, exceptionally heavy, tightly knit, symmetrically shaped coniferous evergreens.
- B. Provide balled and burlap coniferous evergreens.
  - 1. Container-grown coniferous evergreens will be acceptable in lieu of balled and burlap coniferous evergreens subject to meeting ANSI Z60.1 limitations for container stock and provided they are equal in quality and size to balled and burlap material.

## 2.5 BROADLEAF EVERGREENS

- A. Form and Size: Normal-quality, well-balanced, broadleaf evergreens, of type, height, spread, and shape required, conforming to ANSI Z60.1.
- B. Provide balled and burlap broadleaf evergreens.
  - 1. Container-grown broadleaf evergreens will be acceptable in lieu of balled and burlap broadleaf evergreens subject to meeting ANSI Z60.1 limitations for container stock and provided they are equal in quality and size to balled and burlap material.

## 2.6 GRASS/LAWN MATERIALS

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with the Association of Official Seed Analysts' "Rules for Testing Seeds" for purity and germination tolerances.
  - 1. Seed Mixture: Provide seed of grass species and varieties as specified in the plans and/or specifications.
  - 2. Sod shall be as indicated on the plans and detail drawings. Provide machine cut, strongly rooted, certified turf grass sod, not less than two years old, free from weeds and undesirable native grasses and stripped not more than 24 hours before laying. Sod pad size shall be uniform thickness of 5/8", plus or minus 1/4", measured at the time of cutting and excluding top growth and thatch.

## 2.7 TOPSOIL

- A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, 4 percent organic material minimum, free of stones 1 inch (25 mm) or larger in any dimension, and other extraneous materials harmful to plant growth. Sticks, roots, and clay clumps shall be removed from topsoil prior to spreading.
  - 1. Topsoil Source: Reuse surface soil stripped and stockpiled on the site if adequate quantities exist. Verify suitability of surface soil to produce topsoil meeting requirements and amend when necessary. Screen topsoil of roots, plants, sods, stones greater than 1/2" diameter in general lawn areas and planting beds, clay lumps, and other extraneous materials harmful to plant growth. Screen topsoil prior to planting. If inadequate quantities of topsoil exist on-site contractor will be required to import pre-screened topsoil. A minimum depth of 3 inches shall be required.

## 2.8 SOIL AMENDMENTS

- A. Lime: ASTM C 602, Class T, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent, with a minimum 99 percent passing a No. 8 (2.36 mm) sieve and a minimum 75 percent passing a No. 60 (250 micrometer) sieve.
  - 1. Provide lime in the form of dolomitic limestone.
- B. Organic Compost: Organic compost of neutral character, decomposed, stable and weed-free meeting the US Composting Council standards.
- C. Perlite: Horticultural perlite, soil amendment grade.
- D. Peat Humus: Finely divided or granular texture, with a pH range of 6 to 7.5, composed of partially decomposed moss peat (other than sphagnum), peat humus, or reed-sedge peat.

- E. Peat Humus: For acid-tolerant trees and shrubs, provide moss peat, with a pH range of 3.2 to 4.5, coarse fibrous texture, medium-divided sphagnum moss peat or reed-sedge peat.
- F. Sawdust or Ground-Bark Humus: Decomposed, nitrogen-treated, of uniform texture, free of chips, stones, sticks, soil, or toxic materials.
  - 1. When site treated, mix with at least 0.15 lb (2.4 kg) of ammonium nitrate or 0.25 lb (4 kg) of ammonium sulfate per cu. ft. (cu. m) of loose sawdust or ground bark.
- G. Manure: Well-rotted, un-leached 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.
- H. Herbicides: EPA registered and approved, of type recommended by manufacturer.
- I. Water: Potable.
- J. Mycorrhizae: Applied to planting hole backfill or planting bed solid. Product shall be formulated for the moisture regime of the particular planting location (low, medium, high) contain a broad spectrum of mycorrhizae species, an organic bi-stimulant (2-2-2 preferred) and a water holding gel (low moisture locations only). Apply per manufacturer's recommendations.

## 2.9 PLANTER SOIL

- A. Premixed soil containing the following:
  - 1. 20% 5/16" Stalite Expanded Slate or approved equal
  - 2. 20% Stalite Fines or approved equal
  - 3. 30% USGA Root Zone Sand
  - 4. 30% compost
- B. Planter Soil Compost Requirements
  - 1. Humus material shall have an ash content of no less than 8 percent and no more than 40 percent.
  - 2. The ph of the organic matter shall be between 5.5 and 7.5
  - 3. The salt content shall be less than 10 millimho/cm at 25 degrees c, (ece<10) on a saturated paste extract.
  - 4. Types of acceptable composted products can be derived from the following feed stocks: manures, mushroom composts, straw, alfalfa, yard wastes, low in salts, low in heavy metals, free from weed seeds, free of pathogens and other deleterious materials.
  - 5. Composted wood products are conditionally acceptable (stable humus must be present).
  - 6. Sludge-based materials are not acceptable including municipal sewage sludge bio-solids.
  - 7. The organic amendment must have a carbon/nitrogen ratio of <25:1.
  - 8. The compost shall be aerobic without malodorous presence of decomposition products.
  - 9. From 75 to 100 percent organic amendment particles shall pass the 4.0 mm sieve size
  - 10. From 45 to 65 percent moisture measured via wet-weight basis.
  - 11. Free of stones, debris, plant material.
  - 12. Organic amendment must test between 5 to 8 on solvita maturity test.
  - 13. Metals and contaminants must meet or exceed US EPA standard 40

## 2.10 FERTILIZER

- A. Bonemeal: Commercial, raw, finely ground; minimum of 4 percent nitrogen and 20 percent phosphoric acid.
- B. Superphosphate: Commercial, phosphate mixture, soluble; 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-form, phosphorous, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency and as needed to maintain plant material and lawns in a thriving condition.
- D. Slow-Release Fertilizer: Granular fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
  1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency and as needed to maintain plant material and lawns in thriving condition.

## 2.11 MULCHES

- A. Organic Mulch: Organic mulch, free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of the following:
  1. Triple Shredded Hardwood Mulch: At least 80% hardwoods with moisture content of 30% or less, that can pass through a maximum screen size of 1 5/8". Raw material shall contain no yard waste, construction debris, or any other extraneous material.
    - a. Depth: 3" (after compaction)
    - b. Refer to plans for location.

## 2.12 EROSION-CONTROL MATERIALS

- A. Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.
- B. Fiber Mesh: Biodegradable twisted jute or spun-coir mesh, 0.92 lb per sq. yd. (0.5 kg per sq. m) minimum, with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

## 2.13 STAKES AND GUYS

- A. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, redwood, or pressure-preservative-treated softwood, free of knots, holes, cross grain, and other defects, 2 by 2 inches (50 by 50 mm) by length indicated, pointed at one end.
- B. Use flexible Arbor tape or equivalent 3/4" woven belt synthetic fabric strap installed per manufacturer's specifications. Color: Green.
- C. Flags: Standard surveyor's plastic flagging tape, pink, 6 inches (150 mm) long.  
NOTE: Clearly mark all guy wires with flagging for visibility, especially near recreation and pedestrian areas.

## 2.14 LANDSCAPE EDGINGS

- A. "V" Ditch: A 4-inch deep trench by 6 inches width around all planting beds. Except where beds are adjacent to naturally wooded areas due to the possible damage to existing tree roots. Use care around existing tree roots in and around all planting beds. Do not cut existing tree roots to form the "V" ditch, work around them wherever possible.

## 2.15 MISCELLANEOUS MATERIALS

- A. Anti-desiccant: 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 instructions. Apply as per nursery's recommendations. It should be applied prior to plant transport from the nursery where it is dug, if in full leaf.

## 2.16 TACKIFIER

- A. Non-asphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.
- B. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors. (9 gals/1,000 SF).

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas to receive landscaping for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected. Do not seed the site until the Landscape Architect has reviewed the final grades.

#### 3.2 PREPARATION

- A. Lay out individual tree and shrub locations and areas for multiple plantings. Entire areas for multiple plantings shall be chiseled to a depth of 12 inches and tilled and amended to a depth of 8 inches with the same soil mixture as is required for planting backfill material. Stake locations, outline areas, and secure Landscape Architect's acceptance before the start of planting work. Make minor adjustments as may be required.

#### 3.3 PLANTING SOIL PREPARATION

- A. Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.
- B. Mix soil amendments and fertilizers with topsoil at rates indicated. Delay mixing fertilizer if planting does not follow placing of planting soil within a few days.
- C. For tree pit or trench backfill, mix planting soil before backfilling and stockpile at site.
- D. For planting beds, mix planting soil prior to planting.
  - 1. Mix lime with dry soil prior to mixing fertilizer. Prevent lime for lawn plantings from contacting roots of acid-tolerant plants.
- E. Do not attempt soil preparation of plant installation when soils are frozen, wet, in poor tilth or otherwise unsuitable for planting.

#### 3.4 LAWN PLANTING PREPARATION

- A. Limit subgrade preparation to areas that will be planted in the immediate future.
- B. Loosen subgrade to a minimum depth of 8 inches. Remove stones larger than 1/2 inch (19 mm) in any dimension and sticks, roots, rubbish, and other extraneous materials. Remove excess gravel which will inhibit lawn establishment and survival.
- C. Spread topsoil to depth required to meet thickness, grades, and elevations shown, after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen.
  - 1. Place approximately 1/2 the thickness of topsoil required. Work into top of loosened subgrade to create a transition layer and then place remainder of the topsoil.
- D. Preparation of Unchanged Grades: Where lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare soil as follows:
  - 1. Remove and dispose of existing grass, vegetation, and turf. Do not turn over into soil being prepared for lawns.
  - 2. Till surface soil to a depth indicated on soil test report, but at a minimum of 6 inches (150 mm). Apply required soil amendments and initial fertilizers and mix thoroughly into top 4 inches (100 mm) of soil. Trim high areas and fill in depressions. Till soil to a homogenous mixture of fine texture.

3. Clean surface soil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.
  4. Remove waste material, including grass, vegetation, and turf, and legally dispose of it off the Owner's property.
- E. Grade lawn and grass areas to a smooth, even surface with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future. Remove trash, debris, stones larger than 1 inch in any dimension, and other objects that may interfere with planting or maintenance operations. Remove all glass, wire or other objects of any size which may cause injury.
- F. Moisten prepared lawn areas before planting when soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- G. Restore prepared areas if eroded or otherwise disturbed after fine grading and before planting.
- H. Contact Owner and Landscape Architect for review and approval of seedbed preparation and seeding methods prior to and during seeding operations.
- 3.5 EXCAVATION FOR TREES AND SHRUBS
- A. Pits and Trenches: Excavate with vertical sides and with bottom of excavation slightly raised at center to assist drainage. Loosen hard subsoil in bottom of excavation. Refer to planting details.
1. Place tree in pit by lifting and carrying the tree by its ball (never lift by branches or trunk) and then lowering it into the pit. Set the tree straight, plumb and in the center of the pit with the most desirable side of the tree facing the prominent view (sidewalk, building, street, etc.).
  2. Determine the elevation of the root flare and ensure that it is planted at or slightly above finished grade. This may require that the tree be set higher than the grade in the nursery. If the root flare is less than 2-inches below the soil level of the root ball, plant the tree at the appropriate level above the grade, so the flare is even with the grade. If the flare is more than 2-inches at the center of the root ball above the grade, the tree shall be rejected.
- B. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
- C. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.
- D. Fill excavations with water and allow to percolate out, before placing setting layer and positioning trees and shrubs.
- 3.6 PLANTING TREES AND SHRUBS
- A. Set balled and burlap stock plumb and in center of pit or trench with top of ball raised above adjacent finish grades as indicated.
1. Place stock on setting layer of compacted planting soil.
  2. Remove burlap from tops of balls and partially from sides, but do not remove from under balls. Remove the top 2/3's of the wire baskets. Remove pallets, if any, before setting. Do not use planting stock if ball is cracked or broken before or during planting operation.
  3. Place backfill around ball in layers, tamping to settle backfill and eliminate voids and air pockets. When pit is approximately 1/2 backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing and tamping final layer of backfill.
- B. Set container-grown stock plumb and in center of pit or trench with top of ball raised above adjacent finish grades as indicated.
1. Carefully remove containers so as not to damage root balls.
  2. The root ball shall be loosened to alleviate matted or encircling roots. Roots shall be spread out evenly in an outward, radial fashion.
  3. Place stock on setting layer of compacted planting soil.

4. Place backfill around ball in layers, tamping to settle backfill and eliminate voids and air pockets. When pit is approximately 1/2 backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing and tamping final layer of backfill.

C. Dish and tamp top of backfill to form a 3-inch- (75-mm-) high mound around the rim of the pit. Do not cover top of root ball with backfill.

D. Wrap trees of 2-inch (50-mm) caliper and larger with trunk-wrap tape if the species is susceptible to sun or wind scorch. Start at base of trunk and spiral cover trunk to height of first branches. Overlap wrap, exposing half the width, and securely attach without causing girdling. Inspect tree trunks for injury, improper pruning, and insect infestation and take corrective measures required before wrapping. Do not wrap the trees at the base to discourage insect infestation.

### 3.7 TREE AND SHRUB PRUNING

A. Prune, thin, and shape trees and shrubs as directed by Landscape Architect.

B. Only minimal pruning should be necessary at time of planting since plant material shall conform to the specified standards for quality. All pruning performed by the Contractor shall conform to the standards of the current ANSI A300, American National Standard for tree care operations. Under no circumstances shall the Contractor cut or prune leaders or remove more than 1/3 of the top without permission of the Landscape Architect. Prune to remove dead wood, crossovers, split or broken branches. Do not shorten, trim or clip branches solely for appearance purposes unless directed to by the Landscape Architect.

### 3.8 TREE AND SHRUB GUYING AND STAKING

A. Upright Staking and Tying: Stake trees of 2- through 5-inch (50- through 125-mm) caliper. Stake trees of less than 2-inch (50-mm) caliper only as required to prevent wind tip-out. Use a minimum of 2 stakes of length required to penetrate at least 18 inches (450 mm) below bottom of backfilled excavation and to extend at least 72 inches (1800 mm) above grade. Set vertical stakes and space to avoid penetrating balls or root masses. Support trees with 2 strands of flexible Arbor tape or equivalent 3/4" woven belt synthetic fabric strap at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree. Flag heavily in recreation areas or any places where children are likely to be.

### 3.9 MULCHING

A. Mulch backfilled surfaces of pits, trenches, planted areas, and other areas indicated.

B. Organic Mulch: Apply the following average thickness of organic mulch and finish level with adjacent finish grades. Do not place mulch against trunks or stems. Refer to section 2.10 for additional information.

1. Thickness: 4 inches (mulch depth shall be 3" after compaction and settling).

NOTE: Mulch shall NOT be from on-site chipping operations (unless specifically indicated in plans and specifications).

### 3.10 SEEDING NEW LAWNS

A. Sow seed with a spreader or a seeding machine. Do not broadcast or drop seed when wind exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in 2 directions at right angles to each other.

1. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.

B. Sow seed at the rates required to achieve 95% coverage prior to Final completion as determined on a per square yard basis.

C. Rake seed lightly into top 1/8 inch (3 mm) of topsoil, roll lightly, and water with fine spray. Remove surface rocks of greater than 1" diameter.

D. Protect seeded slopes 6:1 (H:V) and steeper against erosion with erosion-control blankets installed and stapled according to manufacturer's recommendations.

- E. Protect seeded areas with slopes flatter than 6:1 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. Tack with liquid asphalt tack (9 gals/1,000 SF) or non-asphaltic tackifier.
- F. If seeding occurs in summer months, protect seeded areas against hot, dry weather or drying winds by applying peat mulch within 24 hours after completion of seeding operations. Soak and scatter uniformly to a depth of 3/16 inch (4.8 mm) thick and roll to a smooth surface.

### 3.11 HYDROSEEDING NEW LAWNS

- A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogenous slurry suitable for hydraulic application.
  - 1. Mix slurry with non-asphaltic tackifier.
  - 2. Apply slurry uniformly to all areas to be seeded in a 2-step process. Apply first slurry application at the minimum rate of 500 lb per acre (5.5 kg per 100 sq. m) dry weight but not less than the rate required to obtain specified seed-sowing rate. Apply slurry cover coat of fiber mulch at a rate of 1000 lb per acre (11 kg per 100 sq. m).

### 3.12 RECONDITIONING LAWNS

- A. Recondition existing lawn areas damaged by Contractor's operations, including storage of materials or equipment and movement of vehicles. Also recondition lawn areas where settlement or washouts occur or where minor regrading is required.
- B. Remove sod and vegetation from diseased or unsatisfactory lawn areas; do not bury into soil. Remove topsoil containing foreign materials resulting from Contractor's operations, including oil drippings, fuel spills, stone, gravel, and other construction materials, and replace with new topsoil.
- C. Where repairable lawn remains, as determined by the Owner, mow, dethatch, core aerate, and rake heavily and deeply. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.
- D. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of it off the Owner's property.
- E. Till stripped, bare, compacted or otherwise unrepairable areas thoroughly to a depth of 8 inches.
- F. Apply required soil amendments and initial fertilizers and mix thoroughly into top 4 inches (100 mm) of soil. Provide new planting soil as required to fill low spots and meet new finish grades.
- G. Apply seed and protect with straw mulch as required for new lawns.
- H. Water newly planted areas and keep moist until new grass is established.

### 3.13 SODDING NEW LAWNS

- A. Lay sod to form solid, uniform mass with tightly fitted joints. "Butt" ends and sides of sod strips. Do not overlap sod strips. Stagger strips to offset joints in adjacent courses. Lay sod strips across slopes and perpendicular to drainage flow. Tamp or roll lightly to ensure contact with subgrade.
- B. Secure with pegs or staples at spacing recommended by the sod grower and supplier and as approved by the Landscape Architect and Owner.
- C. Water sod with fine spray immediately after planting. Water daily during first two weeks of establishment to maintain soil to depth of 4".
- D. At no time shall sodded turf be allowed to grow over 3 inches in height. Throughout this period, the target mowing height shall be 1.5 inches. At no time shall more than 50% of the

turf height be removed in any three-day period by mowing or other maintenance activity.

- E. Sodded turf shall be fertilized according to the monthly application rates recommended in Carolina Lawns for the utilized grass or at reduced rate if instructed by the Landscape Architect.
- F. Weed control shall be provided as necessary to prevent the establishment or proliferation of a weed species and to achieve acceptable turf at time of initial Acceptance.
- G. Remove all poly mesh netting prior to placement and dispose of off-site.

#### 3.14 INSTALLATION OF EDGINGS

- A. "V" Ditches: Clearly delineate planting beds, and sign locations with a 4-inch deep by 6-inch wide ditch. Lines shall be smooth. A minimum five-foot wide lawn strip shall be provided between planting beds and paved surfaces where shown on the drawings.

#### 3.15 INSTALLATION OF MISCELLANEOUS MATERIALS

- A. Apply anti-desiccant using power spray to provide an adequate film over trunks, branches, stems, twigs, and foliage.
  - 1. When deciduous trees or shrubs are moved in full-leaf, spray with anti-desiccant at nursery before moving and again 2 weeks after planting.

#### 3.16 INSPECTION AND ACCEPTANCE

- A. When landscape work is completed, including maintenance, Architect will, upon written request, make a final inspection to determine acceptability.
- B. At time of inspection for initial Acceptance, turf shall have been freshly mowed within the last 48 hours. Turf shall be healthy, of uniform color and exhibiting signs of good growth. A minimum of 95% of the specified seeding area shall be covered in established turf possessing both stolens (i.e. runners) and rhizomes. There shall be no bare areas greater than 4 sq. ft. or 1.5 ft. in any dimension. Seedling plants not having reached tiller stage (i.e. runner producing) shall be considered bare area. Turf shall be 100% free of noxious and perennial weeds and relatively free of annual weeds.
- C. At time of inspection for initial Acceptance, sodded and sprigged turf shall have been freshly mowed within the last 48 hours. Turf shall be healthy, of uniform color and exhibiting good growth. A minimum of 100% of the specified turf area shall be covered in sod that has been installed for a minimum six weeks. Turf shall be 100% free of all weeds.
- E. When inspected landscape work does not comply with requirements, replace rejected work and continue specified maintenance until re-inspected by Architect and found to be acceptable. Remove rejected plants and materials promptly from project site.

#### 3.17 CLEANUP AND PROTECTION

- A. During landscaping, keep pavements clean and work area in an orderly condition.
- B. Protect landscaping from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

#### 3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of it off the Owner's property unless an agreement is made with the Owner otherwise.

#### 3.19 FIELD QUALITY CONTROL

- A. Owner's Independent Testing Agency Services: Allow testing agency to evaluate and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.

END OF SECTION 329000

**SECTION 33 1000**  
**SECTION 01 - 2005**  
**PCU WATER SPECIFICATIONS**

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## PART 1 - GENERAL

### 1.1 QUALITY ASSURANCE

All water mains, appurtenances and construction methods shall adhere to the following standards where applicable:

A. Standards:

1. American National Standards Institute
  - a. ANSI A21.10 ductile cast iron fittings
  - b. ANSI A21.11 ductile cast iron fittings
  - c. ANSI 21.4 ductile cast iron pipe cement lining
  - d. ANSI A21.51 ductile cast iron pipe
  - e. ANSI A21.6 ductile cast iron pipe dimensions
  - f. ANSI A21.8 ductile cast iron pipe dimensions
  - g. ANSI B16.1 ductile cast iron fittings
  - h. ANSI B16.b ductile cast iron fittings
2. American Society for Testing and Materials
  - a. ASTM A48 cast iron butterfly valve body
  - b. ASTM A126 cast iron butterfly valve body
  - c. ASTM A252 encasement pipe
  - d. ASTM A339 ductile cast iron fittings
  - e. ASTM A436 cast iron butterfly valve disc
  - f. ASTM C33 crushed stone
  - g. ASTM D1598 pipe tests
  - h. ASTM D1599 pipe tests
  - i. ASTM D1784 PVC pipe
  - j. ASTM D2152 pipe tests
  - k. ASTM D2241 PVC pipe
3. American Water Work Association
  - a. AWWA C110 cast iron fittings
  - b. AWWA C111 cast iron fittings
  - c. AWWA C151 ductile cast iron pipe
  - d. AWWA C301 pipe gaskets
  - e. AWWA C500 gate valves
  - f. AWWA C502 fire hydrants
  - g. AWWA C504 butterfly valves
  - h. AWWA C515 gate valves
  - i. AWWA C600 pipe installation
  - j. AWWA C900 PVC pipe

4. American Association of State Highway Transportation Officials
    - a. AASHTO T99 compaction of backfill
    - b. ASTM 698 Soil Density
  5. Federal Specifications
    - a. WW-P-42 IB
    - b. WW-P-421C ductile cast iron pipe joints
    - c. WW-P-4211 pipe gaskets
- B. Soil Testing
1. Retain the services of a testing laboratory to perform all density tests required at the project site. In areas of fill and back fill, field density tests shall be performed in sufficient numbers to insure that the specified density is obtained.
    - a) All defective work of material shall be repaired and/or areas in which testing indicates compaction below the specified density shall be reworked, or removed and replaced until specified compaction is obtained.
- C. Soil Erosion Control
1. Siltation, sedimentation, and erosion shall be kept to a minimum at all times during construction. The Contractor shall employ sedimentation and erosion control methods during construction in order to comply with the requirements of the N.C. Sedimentation Pollution Control Act of 1973, and to plan requirements.
- D. Material Testing
1. Material shall be tested in accordance with the General Conditions of these Specifications and the following:
    - a. Pipe: Each joint of pipe shall be subjected to successfully meet a hydrostatic proof test in accordance with AWWA requirements for each type. Cast iron pipe shall be tested prior to lining. Certified test results shall be furnished to the Owner, for each shipment of pipe.
    - b. PVC Pipe: PVC pipe shall be given the Quick Burst Test in accordance with ASTM D1599; Sustained Pressure Test in accordance with ASTM D1598; Acetone Immersion Test in accordance with ASTM D2152; Vise Flattening Test (compress 2" long ring in less than 1 minute to 100% flattening without evidence of splitting or shattering); and Drop Impact Test C. (Single impact load from a free-falling missile having a 2" diameter rounded, 1" long nose compacted on a 6" long horizontal specimen. No shattering or splitting shall occur at the following energies 12" nominal size - 24 ft-lb, 2" - 57 ft-lb, 4" - 86 ft-lb, and 6" 100 ft-lb).
    - c. Pipe Fittings: Pipefittings shall be subject to inspection and testing in accordance with standard manufacturing practice.
    - d. Gaskets: Gaskets shall be tested, if required, in accordance with Section 3-4 of AWWA C301, and ANSI A21.11.

- e. Valves: Valves shall be tested to double the design working pressure and test results submitted to the Owner upon request.
- f. Other Material: Other material shall be subject to such testing as the Owner may require should its acceptability be questioned.
- g. System Testing:
  - 1) Pressure Test:
    - a) After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure of at least 150% the working pressure at the point of testing or 150 psi whichever is greater.
    - b) Test Pressure Restrictions: Test pressures shall be:
      - (i) 150 PSI
      - (ii) Not exceed pipe or thrust restraint design pressures.
      - (iii) Be of at least 2-hour duration.
      - (iv) Not vary by more than plus or minus 5 psi.
      - (v) Not exceed twice the rated pressure of the valves or hydrants when the pressure boundary of the test section includes closed gate valves or hydrants.
      - (vi) Not exceed the rated pressure of the valves if resilient-seated butterfly valves are used.
    - c) Pressurization: Each valved section of pipe shall be filled with water slowly and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe.
    - d) Air Removal: Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at high points, the Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged, or left in place.
    - e) Examination: All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves, or hydrants that are discovered following the pressure test shall be repaired or replaced with sound material, and the test shall be repeated until it is satisfactory.

2) Leakage Test: A leakage test shall be conducted concurrently with the pressure test.

- a) Leakage Defined: Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.
- b) Allowable Leakage: No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = S \times D \times (P/\text{square root})/148,000$$

L - the allowable leakage in gallons per hour

S - the length of the tested section, in feet

D - the nominal diameter of the pipe, in inches

P - the average test pressure during the leakage test, in pounds per square inch gauge

- c) When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gal/hr/in. of nominal valve size shall be allowed.
- d) When hydrants are in the test section, the test shall be made against the hydrant.
- e) Acceptance of Installation: Acceptance shall be determined on the basis of allowable leakage. If any test of pipe laid discloses leakage greater than that specified by the leakage test requirements of this Section, the Contractor shall, at his own expense, locate and repair the defective material until the leakage is within the specified allowance.
- f) All visible leaks are to be repaired regardless of the amount of leakage.
- g) Should any test disclose leakage greater than that allowed above, the Contractor shall, at his own expense, locate and repair the defect until the leakage is within the specified allowance.

3) Sterilization:

- a) Before any potable water main is placed in service, it shall be flushed out and sterilized with chlorine or calcium hypochlorite. The sterilizing solution shall be introduced at one end of the main as water is being withdrawn from the other end, in such proportion as to give 50 ppm of free chlorine throughout the main. The solution shall remain in the pipe for 24 hours, at which time it shall have residual chlorine of 10 ppm throughout the main, or the process shall be repeated. The line shall be flushed out and bacterial analyses shall show negative results, if necessary, the process shall be repeated. Furnish all chemicals required.
- b) Furnish all necessary pipe or hose extensions or transportation to the point of use and shall exercise care in the use of water. The maximum flow rate that can be extracted from the Owner's system is 200 gallons per minute. A higher flow rate for flushing large diameter lines will be allowed at certain times of the day and week as approved by the Owner.
- c) Upon completion of sterilization, the water line shall be refilled with water. Generally, a sample will be taken every 2,000' for distribution lines and every 4,000' on transmission lines. Samples may be taken at new service connections, at air valve stations, or through any other connection to the line 1" or smaller in diameter. Samples shall not be taken at fire hydrants. The samples shall be taken in standard sterilized bacteria sample bottles marked with the project name and sample location. Bacteriological samples collected following new water main disinfection should be performed by a North Carolina State Certified Laboratory, per Rule .1001 of the *Rules Governing Public Water Systems*. Results of the analysis shall be furnished to the Owner.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. General:

1. All materials and appurtenances shall meet the following minimum standard requirements below;
2. Pipe shall comply with all applicable AWWA Standards at each type and to the following:
  - a. Trench width for buried pipe design shall be considered as the outside diameter of the pipe plus 2', from the bottom and up to 1" above the top of the pipe.

- b. Buried pipe shall be designed for laying condition "C" (flat bottom trench-tamped backfill) to withstand all internal pressures and external loads with a minimum depth of cover of 3', for pipelines 8" and smaller in diameter, and 3'-6" for lines 10" and larger in diameter, and greater depths of cover where required by the Plans, plus an H-20 live load in accordance with A.A.S.H.T.O. Specifications.
- c. Design pressure shall consist of 150-psi working pressure plus 100-psi surge allowance unless noted differently.
- d. Pipe diameters shown or called for shall be the minimum net inside diameter of the pipe after any required lining is placed, with a maximum tolerance of 3" on minus side, for sizes through 36" diameter.
- e. Pipe fittings shall be of the size, configuration and type called for in the Plans. All fittings shall be of at least the same class as the pipe with which they are used. Ductile or gray cast iron fittings shall be used with all ductile and gray cast iron pipe, asbestos cement pipe, and PVC pipe (4" or larger in diameter).
- f. All valves shall have standard mechanical joint ends, except where flanged or other type ends are specifically required. Flanges, where required shall be 125 lb. ANSI standard unless otherwise indicated. All valves shall be furnished with operating nuts, or hand wheels as necessary, except in instances where other operating devices are specified or shown. All valves shall be of at least the same class of the pipe with which they are used. A cast iron valve box and cast iron cover marked "WATER" shall be provided for each underground valve except where shown differently on the Plans. Cast iron rings and covers shall be provided for all air valves and concrete vaults as detailed.

## 2.2 DUCTILE CAST IRON PIPE

- A. Ductile cast iron pipe shall be centrifugally cast of ductile cast iron having a minimum tensile strength of 60,000 psi, minimum yield strength of 42,000 psi, and a minimum elongation of 10% (Grade 60-42-10). It shall be designed, manufactured, and shall conform to the requirements of ANSI A21.50 and A21.51, for a minimum 150 psi operating pressure plus a minimum allowance of 100 psi for surge.
- B. Nominal laying lengths shall be 18' or 20' nominal maximum of 20% of each size for each order being as much as 24" shorter than the nominal laying length and an additional 10% as much as 6" shorter than nominal laying length.
- C. Pipe joints shall be either Type II or Type III in accordance with Federal Specification WW-P-42 IC except where flanged ends are specifically required.
- D. Dimensions shall conform to the requirements of ANSI LA21.6, ANSI A211.8, ANSI A21.11, and WW-P-42 IC, as applicable. Dimensions shall be gauged at sufficiently frequent intervals to assure dimensional control. Insides of sockets and outside of spigot ends shall be tested with circular gauges.

- E. Minimum nominal wall thicknesses and allowable depths of cover shall be as follows:

Maximum Depth Cover	Pipe Diameter (inches)									
	4	6	8	10	12	14	16	20	24	30
5	0.26	0.25	0.27	0.29	0.31	0.33	0.34	0.36	0.38	0.30
8	0.26	0.25	0.27	0.29	0.31	0.33	0.34	0.36	0.38	0.39
12	0.26	0.25	0.27	0.29	0.31	0.33	0.34	0.39	0.44	0.44
16	0.26	0.25	0.27	0.29	0.31	0.36	0.37	0.42	0.50	0.51

Ductile iron pipe shall be minimum Class 50.

- F. Tolerances below the standard thickness of pipe and bell shall not exceed:

Size	Allow. Minus Tolerances (inches)
4-8	0.05
10-12	0.06
14-12	0.07

- G. All pipes shall be tested at the factory in accordance with AWWA requirements for each type.
- H. Underground pipe shall be coated on the outside with asphaltic coating per ANSI A21.51. The coating shall be continuous, smooth, and strongly adherent to the pipe and shall not become brittle from cold or sticky from the heat.
- I. Interior surfaces of each pipe, for water service, shall be cement lined in accordance with ANSI, 21.4, with minimum thickness of 1/16" for 3" to 12" pipe and 3/32" for 14" to 24" pipe, and 1/8" for 30" to 48" pipe.
- J. Each pipe shall be weighed prior to placing of the inside lining. Weight, nominal thickness, sampling period, and class of pipe shall be shown on each pipe. The manufacturer's year of production and the letters DI or Ductile shall also be cast or stamped on the pipe. All markings shall be clear and legible and on, or near, the bell end.

## 2.3 POLYVINYL CHLORIDE PIPE

- A. PVC pipe shall be rigid polyvinyl chloride with integrally formed, factory-fabricated bell, for rubber type joint rings. It shall be suitable for all conditions imposed by Plan locations and for a maximum working pressure of 150 psi, plus 100 psi surge allowance at 73°F. Pipe shall be Type 1, Grade 1, made from clear virgin material

and shall conform to the requirements of Commercial Standard C5 256, ASTM D1784, ASTM D2241 and with standard dimension ratio C900 DR 18 PVC pipe. All pipes shall bear the National Sanitation Foundation Seal of Approval for potable water, the manufacturer's name, and class of pipe.

- B. Pipe color shall be blue.

## 2.4 DETECTABLE TAPE

- A. A detectable tape for protection of underground water lines shall be used above all water lines. The tape shall be an inert, bonded layer plastic with a metalized foil core and shall be highly resistant to alkalis, acid, or other destructive chemical components likely to be encountered in soils. The tape shall be brightly colored to contrast with soil and shall bear an imprint identifying the type of line buried below. The tape shall be a minimum of 2" wide.
- B. The tape shall be buried a maximum of 12" below the ground surface directly above the water line with printed side up. The Contractor shall take necessary precaution to insure that the tape is not pulled, distorted or otherwise misplaced in completing the trench backfill. The tape shall be Terra Tape as manufactured by Griffolyn Co., Inc., or an approved equal.
- C. Tracer wire is required in addition to Detectable Tape. Tracer wire shall be 12 gauge THHN or better.
- D. Tracer wire for Horizontal Directional Drilling shall be Copperhead Solo Shot Extreme, or Equal. All wire connections are required to be direct bury connectors.

## 2.5 WATER SERVICE MATERIALS

- A. See details on plans for water service materials.

## 2.6 STEEL ENCASUREMENT PIPE

- A. Steel encasement pipe shall be bituminous coated inside and outside. Bituminous coating shall be 6 mil. Minimum thickness. Steel encasement pipe shall have a minimum thickness as indicated in the plans for bores under highways and shall meet ASTM specifications A252 with a minimum yield strength of 35,000 psi. Wall thickness of steel encasement pipe shall comply with the latest North Carolina Department of Transportation regulations.

## 2.7 DUCTILE CAST IRON FITTINGS

- A. Ductile cast iron fittings shall conform to the requirements to ANSI Specification A21.10, with mechanical joint ends conforming to ANSI Specification A21.11, except that material and manufacturer shall conform to ASTM Specification A339, Grade 80-60-3 and compact fittings shall conform to ANSI/AWWA C 153/A21.53. All fittings shall be bituminous coated and cement lined as required for pipe. Where flanged ends may be required, flanges shall conform to applicable requirements of ANSI B16.1 and ANSI B16b. Minimum class shall be equal to class pipe used.

## 2.8 PVC FITTINGS

- A. PVC fittings and adapters shall conform to the same requirements as for pipe and shall be the same class as the pipe.

## 2.9 TAPPING SLEEVES AND SADDLES

- A. Tapping sleeves shall be mechanical joints or caulked type with 125 lb. ANSI Standard outlet flange, suitable for 150 psi. Tapping Saddles shall be banded type, with two (2) bands for ductile iron pipe and hinged type for PVC pipe, suitable for bolting in place on the pipe to be tapped. Sleeve shall have a single rubber gasket cemented in place on the inside of the sleeve body. Sleeve shall meet all the requirements of ANSI/AWWA C110/A21.10 and C111/A21.1.
- B. Tapping sleeves greater than 2" diameter shall be stainless steel with carbon steel flanged outlet, and conform to the following:
  - 1. Body, straps and UNC threaded studs are made of 18-8 Type 304 stainless steel. Flange can be either ASTM A240 Type 304 stainless steel or ASTM carbon steel.
  - 2. All sleeves shall be fully passivated for corrosion resistance.
  - 3. Tapping sleeves shall be rated for 250 psi working pressure on 2" – 12" lines.
  - 4. Outlet gasket shall be Buna-N rubber per ASTM D2000.
  - 5. Sleeve shall be UL Classified to ANSI/NSF Standard 61.
- C. Tapping saddles are not allowed when connecting main diameter is 50% or larger than existing main to be tapped.

## 2.10 JOINT MATERIAL

- A. Gaskets for pipe and fittings shall be continuous ring of rubber material compounded to resist deterioration and of a texture to assure a permanent and watertight seal. They shall have smooth surfaces, free from pitting, blisters, porosity or any other defects. Gaskets shall conform to the requirements of AWWA Specification C301 and Federal Specification WW-P4211.
- B. Gasket lubricant shall be a potable hydrogenated vegetable oil, insoluble in cold water, non-toxic, shall not support the growth of bacteria, and shall not impart taste or odor to the water. It shall not contain detergents soaps, organic solvents or other deleterious ingredients and shall have no deterioration effects on the gaskets. The lubricant shall be semi-paste, easily applicable, readily adherent to the inside of the bell and shall remain in a usable state throughout the range of temperature in which pipe is normally installed. Lubricant shall be delivered to the job site in unopened containers bearing the manufacturer's name and trade name or trademark, NSF approved.

## 2.11 GATE VALVES

- A. Gate valves (2" through 12") shall be iron body or resilient seat, non-rising stem and provided with suitable stem seals. They shall comply with AWWA C515, and be designed for an operating pressure of 150 psi. All valves shall open left (counter clockwise). Buried valves shall have a 2" square operating rest. Extension stems shall be furnished where depth of bury places operating nut in excess of 4' below finished

grade. No extra compensation for extension stem will be forthcoming. Gate valves shall be as manufactured by American-Darling Valve and Mfg., M&H Mueller Co., Dresser, Allis Chalmers, Clow Valve, or approved equal.

- B. Sixteen inch (16") valves and larger shall be equipped with bevel gear operator and bypass line with valve. The bypass line and valve shall be 3" diameter for valves under 24" and 4" diameter for valves 24" and larger. The gear mechanism shall be totally enclosed with watertight gear case, suitable for underground installation. The valves shall be designed for installation in a horizontal position and shall be equipped with track, scrappers, and rollers or trunions. Valve interior coating shall be the industry standard unless otherwise specified. Buried valves shall be bituminous or asphalt coated as specified in this section. Valves for non-buried service shall have the exterior prime coated only. Gate valves shall be as manufactured by American- Darling Valve and Mfg., M&H Mueller Co., Dresser, Allis Chalmers, Clow Valve, or approved equal.

## 2.12 BUTTERFLY VALVES

- A. Butterfly valves shall be tight closing, rubber-seated valves, conforming to the class required by use and location as shown on the Plans. Valve bodies shall be of heavy-duty cast iron. ASTM A126, Class B or ASTM A436, Type 1, with stainless steel seating edges. Valve shafts shall be one-piece straight through, or stub shaft, Type 304, or Type 316, 18-8 stainless steel and of sufficient size. Valve shafts may also be solid one-piece high tensile strength carbon steel, with 304 stainless steel journals at places where corrosion resistance is required. Bearings shall be of bronze, Teflon, or other material acceptable to the Owner, and valve seats shall be of rubber, neoprene, or other acceptable material. Valves shall provide 90 closures and shall be bubble tight after installation, when subjected to twice the design working pressure. Valve seating shall be continuous uninterrupted 360.
- B. Each valve shall be equipped with a suitable underground type, totally enclosed, 2" nut operator designed to hold the valve disc in any intermediate position, between fully open and fully closed, without creeping or fluttering. Manual operator shall be the worm and gear, traveling nut, or lead screw type and shall be self locking. All valves shall open left (counterclockwise).
- C. Valves and operators shall be satisfactory for frequent operation and for application involving operation after long periods of inactivity. Valve coatings shall be as specified in this Section.
- D. Butterfly valves for water transmission mains shall be as manufactured by Allis Chalmers, B.I.F., Henry Pratt Company, Dresser Industries, American-Darling, Mueller, Clow Valve, or approved equal.

## 2.13 PRESSURE AIR VALVES

- A. Valve interior and exterior coatings shall be the industry standard unless otherwise specified. Pressure air valves shall be either Crispin Pressure Air Valves as made by Multiplex Manufacturing Company, or APCO valves as made by Valve and Primer Corporation, or valves of equal characteristics. The valves may be compact in size and shall be designed for at least 150 psi pressure. Vaults to house Pressure Air Valves shall be concrete and conform to details.

## 2.14 FIRE HYDRANTS

- A. Fire hydrants shall be of the compression type, dry top, and traffic model of cast iron and shall conform to the requirements of AWWA C502. They shall have 6" mechanical joint connections with a minimum 5 ¼" main valve. Connection of valve seat to drain ring shall be bronze-to-bronze threads. Each hydrant shall have two 2½" hose nozzles and one 4 ½" pumper nozzle, with washers. Barrel lengths shall be generally for 4½' to 5' trench, except where other lengths are necessitated by the hydrant location. The threads, operating nuts and direction of opening shall be identical to that of existing hydrants or are of the types desired by the Owner.
- B. The hydrant barrel shall be made in two sections joined together a few inches above the ground line by a watertight coupling, or break ring, so designed that if a break occurs, it will occur at this point. Breakaway bolts are not acceptable. The ring shall be of ample strength for ordinary service, and be easily and cheaply replaceable. The valve stem shall be in two sections, joined by a special coupling at the same point as the break ring, so designed that if the hydrant is broken, the coupling will break and the valve not be disturbed. All working parts shall be removable without disconnecting the hydrant. Fire hydrants shall be as manufactured by Clow Medallion (with stainless steel stems), and EJ 5CD250 with Pender County options 981, or approved equal.
- C. The hydrant leg shall be C900 DR 18 PVC pipe.
- D. Fire hydrants shall be painted with a reflective two-tone color scheme; red hydrant with silver caps and bonnet. The hydrants shall be cleaned, primed, and painted with a minimum of a two-coat system. The fire hydrant top and all caps shall receive the reflective paint.
- E. One fire hydrant repair kit shall be provided for every ten (10) fire hydrants installed. Provided to Inspector at the end of project.
- F. Fire hydrants that have been installed but are not ready for service shall be bagged/covered until such time the hydrants are placed into service.

## 2.15 BLOW-OFFS

- A. Blow-offs shall conform to plan details and shall be of the type shown. The valve shall meet the requirements for other gate valves and shall be suitable for the anticipated pressure. Blow-offs shall be furnished with concrete valve markers.

## 2.16 VALVE MARKERS

- A. Valve markers shall be as shown on the plans and of concrete, reinforced as shown. Concrete shall be of a mix designed to produce a 3000-psi compressive strength at 28 days. They shall be marked with recessed letters, MV, AV, or BO as appropriate and installed facing item to be located.

## 2.17 VALVE BOXES

- A. Adjustable 2-piece valve boxes shall be gray cast iron in conformance with ASTM A48, Class 30. Lids shall be heavy-duty traffic weight with the word "WATER" cast into the lid. Provide cast-iron screw type top section of length required for depth of burial of

valve and bottom section with base of size to fit over valve. Valve boxes shall be coated inside and out with asphalt. Acceptable valve boxes are: Sigma Corporation Model V-8459, Capitol Foundry of Virginia, Inc., Model VB-FCWA #3435, or equal.

## 2.18 CRUSHED STONE

- A. Crushed stone for pipe foundation shall meet ASTM C33 #67 stone graded 2" to 1".

## 2.19 CONCRETE

- A. Concrete for protection and thrust blocks shall be composed of Portland Cement, sand; coarse aggregate, water, and such admixtures as may be allowed, in such proportions as to provide in minimum compressive strength of 3,000 psi.

## 2.20 BACKFLOW PREVENTER

- A. The RP must be installed a minimum distance of five (5) feet from the meter service. Backflow preventers installed within the utility right of way will not be approved.
- B. RP's must be installed in a horizontal position and in a location in which no portion of the RP can become submerged under any circumstances.
- C. RP's must be installed above ground.
- D. Backflow preventers installed inside must be a minimum distance of twelve (12) inches above the floor, and no higher than four (4) foot above the floor, with adequate clearance around the backflow preventer for testing and/or repair. When an RP is installed inside a building an air gap drain line large enough to carry off the discharge of water from the relief valve shall be installed.
- E. RP's installed outside must be protected from freezing, must be installed a minimum distance of twelve (12) inches above the ground, and no higher than four (4) foot above ground. Landscaping is allowed around the backflow preventer, but must not interfere with the required testing, and/or repair.
- F. Backflow prevention assemblies two and one half (2-1/2) inches and larger must be supported to allow for the weight of the backflow prevention assembly. Supports must have a proper footing (four (4) inches of concrete) for supports to rest upon. Backflow prevention assembly supports must not interfere with the valves, test cocks, testing, and/or repair of the backflow prevention assembly.
- G. In order to prevent obstruction during the testing and/or repair of the assembly, additional piping and/or valves shall not be located within the enclosure.
- H. Reduced Pressure (RP or RPZ) Backflow Preventers – ¾" thru 2": ASSE 1013, AWWA C511, CSA B64 Certified and USC Foundation for Cross Connection Control and Hydraulic Research approved, lead-free, with full port, resilient seated ball valve shut-off valves and ball valve test cocks. Include 2 spring loaded, center stem guided check valves and one hydraulically dependent differential relief valve.
- I. Reduced Pressure (RP or RPZ) Backflow Preventers – 2-1/2" thru 10": ASSE 1013,

AWWA C511, CSA B64 Certified and USC Foundation for Cross Connection Control and Hydraulic Research approved, FM approved or UL listed, lead-free, with OS&Y gate valves on inlet and outlet, and strainer on inlet. Include test cocks and pressure-differential relief valve with ASME A112.1.2 air gap fitting located between 2 positive-seating check valves for continuous-pressure application. Assembly shall be of a compact design utilizing a flow orientation of inlet flow vertical up, outlet flow vertical down at the direct outlet of the gate valves.

- J. Reduced Pressure Detector Assembly (RPDA) Backflow Preventers – 2-1/2" thru 10": ASSE 1047, USC Foundation for Cross Connection Control and Hydraulic Research approved, FM approved and UL listed, lead-free, with OS&Y gate valves on inlet and outlet, and strainer on inlet. Include test cocks and pressure-differential relief valve with ASME A112.1.2 air gap fitting located between 2 positive-seating check valves and test cocks, and bypass with displacement-type water meter, valves, and reduced pressure backflow preventer, for continuous-pressure application. Assembly shall be of a compact design utilizing a flow orientation of inlet flow vertical up, outlet flow vertical down at the direct outlet of the gate valves. Gate valves on backflow preventers on fire protection systems shall be equipped with supervisory switches.

## 2.21 FIRE DEPARTMENT CONNECTIONS

- A. Fire Department Connections: 5-in x 4-in with 30-deg turndown, 5-in Storz connection inlet, 4-in female NPS outlet, lead-free. Include cap and chain; fixed (no swivel) connection. Connect to fire backflow preventer piping with 4-in flanged piping, including a wafer check valve as shown on the drawings. Provide round escutcheon plate marked "AUTO SPRKLR" where pipe penetrates backflow enclosure wall. Provide 1-in, ¼ (quarter) turn valve tapped into FDC pipe.
- B. Wafer Check Valve: UL Listed/FM Approved, lead free, ductile iron body, bronze clapper and seat ring, 'O' ring seals, stainless spring closure, with ½" ball drip valve below seat to allow valve to drain water from FDC.
- C. Signage: All-weather sign or decal with white background with min. 6" red lettering, marked FDC, mounted on the backflow preventer enclosure as directed by fire official.

## 2.22 PROTECTIVE ENCLOSURES

- A. General: Manufactured, ASSE 1060 certified, weather-resistant enclosure designed to protect aboveground water piping equipment or specialties. Enclosures shall be sized as required for access and service of protected unit. Enclosures for compact design backflow preventors shall be no larger than 64"(L)x60"(W)x60"(H). Enclosures shall be as manufactured by Hot Box or approved equal.
  - 1. Housing: Reinforced-aluminum or reinforced-fiberglass construction with factory applied paint. Paint color to be selected by Designer from manufacturer's standard color choices. Unpainted aluminum exterior will not be allowed.
  - 2. Drain opening: Sized to alleviate a full release by the backflow preventer.
  - 3. Access doors with locking device.
  - 4. Insulation inside housing.

5. Thermostatically controlled electric heater (for 2-1/2" or larger backflow preventers) or plug-connected self-limiting temperature control pipe heating cable (for 2" and smaller backflow preventers) and connection to power supply. Heating equipment shall be designed and furnished by the enclosure manufacturer.
6. Concrete base slab: 4 inch thick of dimensions required to extend at least 6 inches beyond edges of housing. Provide PVC sleeves at pipe penetrations of slab.
7. Anchoring devices to attach housing to base with stainless steel mounting hardware.
8. Coordination: Coordinate with other trades for installation of electrical services, GFI, tamper switches, temperature sensors, and connections to fire alarm systems as applicable. Locate GFI and other electrical components away from water discharge from backflow devices.

## **PART 3 - EXECUTION**

### **3.1 LOCATIONS**

- A. Ensure that all rights-of-way, permits, or other legalities are in order. All work shall be confined to rights-of-way or permit limits.

### **3.2 RELATION OF WATER MAINS TO SEWERS**

- A. *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-ft lateral separation in which case (1) 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 (2) 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.
- B. *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.
- C. *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.

### **3.3 BORED ENCASUREMENT INSTALLATION**

- A. Pipelines installed through steel encasement shall meet the specifications herein described and all Department of Transportation or Railroad specifications and guidelines for installing pipelines through steel encasement pipe. Upon insertion of the pipeline through the encasement pipe, the ends of the pipe shall be sealed per the detail. The seal shall be such to withstand hydrostatic pressure from ground water

and backfill loads. Provide means to prevent water line from floating within the encasement pipe. Grouting procedure will not be allowed.

- B. Casing pipe and joints shall be of leak proof construction, capable of withstanding railway or traffic loading. The diameter of the casing pipe shall be at least 2" greater than the largest outside diameter of the carrier pipe, joints, or couplings for carrier pipe less than 6" in diameter and at least 4" greater for carrier pipe, 6" in diameter and greater, unless indicated differently on the detail. Further, the casing pipe shall be of great enough diameter to allow the carrier pipe to be removed without disturbing the case pipe.
- C. Each section of carrier pipe within the encasement pipe must have a minimum of two spacers/supports.

### 3.4 DIRECTIONAL

#### DRILLING PART 1 –

#### GENERAL

##### 1.1 QUALITY ASSURANCE

###### A. Requirements

- 1. Requirements of Regulatory Agencies:
  - a) Comply with North Carolina OSHA Standards, Underwriter Laboratories and all other authorities having jurisdiction.
- 2. Manufacturer shall have manufacturing and quality control facilities capable of producing and assuring the quality of the pipe and fittings required by these specifications.

###### B. Reference Standards

- 1. Comply with applicable provisions and recommendation of the following, except as otherwise shown or specified.
  - a) AWWA C906, Polyethylene (PE) Pressure Pipe and Fittings, 4-inch through 63-inch, for Water Distribution
  - b) AWWA M55 – Measures to resist the contractive Poisson Force effects of HDPE pipe being filled
  - c) ASTM D3261 - Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
  - d) ASTM D3350 - Standard Specifications for Polyethylene Plastic Pipe and Fittings Materials

- e) PPI TR-3 Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe Materials
- f) PPI TR-4 Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Pipe and Fittings Compounds
- g) NSF Standard #14 - Plastics Piping Components and Related

## Materials PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Material shall be high-density polyethylene pipe, SDR 9, Class 200.
- B. Pipe shall be butt heat fusion welded.
- C. The outside diameter of the HDPE pipe may be either iron pipe size or ductile iron pipe size. Contractor shall furnish and install all necessary transition couplings or fittings to connect to the main pipe for a complete and acceptable installation.

### 2.2 PIPE

- A. Polyethylene pipe shall be manufactured in accordance with AWWA C906.
- B. Permanent identification of piping service shall be provided by co-extruding longitudinal blue (water main) or green (sewer line) stripes into the pipe's outside surface. The striping material shall be the same material as the pipe material except for color. Stripes printed or painted on the pipe outside surface shall not be acceptable.

### 2.3 FITTINGS

- A. Polyethylene fittings shall be made from material meeting the same requirements as the pipe. Polyethylene fittings shall be molded or fabricated by the manufacturer of the pipe.
- B. Where applicable, fittings shall meet the requirements of AWWA C906.
- C. Molded fittings shall be manufactured in accordance with ASTM D3261 (butt fused) and shall be so marked.
- D. Mechanical fittings used with polyethylene pipe shall be specifically designed for, or tested and found to be acceptable for use with polyethylene pipe. Mechanical fittings designed for other materials shall not be used unless authorized by the mechanical fitting manufacturer. Special precautions may exist with certain mechanical fittings or additional components may be required--consult the manufacturer of the fitting prior to its use.

### 2.4 TESTING

- A. Pipe shall be pressure tested and leak tested in accordance with Water System Materials and Installation specifications.

- B. On each day butt fusions are to be made, the first fusion of the day shall be a trial fusion. The trial fusion shall be allowed to cool completely, and then fusion test straps shall be cut out. The test strap shall be 12" or 30 times the wall thickness in length (minimum) and 1" or 1.5 times the wall thickness in width (minimum). Bend the test strap until the ends of the strap touch. If the fusion fails at the joint, a new trial fusion shall be made, cooled completely and tested. Butt fusion of pipe to be installed shall not commence until a trial fusion has passed the bent strap test.
- C. Owner's representative shall be available during the testing.

## 2.5 STORAGE AND HANDLING

- A. Handle all pipe and accessories carefully with approved handling devices. Do not drop or roll pipe off trucks. Do not otherwise drop, roll or skid pipe. Materials cracked, gouged, chipped, dented or otherwise damaged will not be approved.
- B. Pipe and appurtenances shall be unloaded opposite to or as close to the place where they are to be laid as is practical to avoid unnecessary handling. Interiors shall be kept completely free from dirt and foreign matter.
- C. Contractor shall be responsible for the proper support of the piping to ensure that the pipe is not over stressed or damaged.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General:
  - 1. The Directional Drill Technique shall perform the work. In general, the Work will proceed as follows:
    - a) Drill a pilot hole from one side of the crossing to the other. The pilot hole follows the design centerline of the pipe with the path recorded and controlled using a specially designed instrument package situated behind the drill bit.
    - b) A wash over pipe is rotated over the pilot drill string behind the pilot drill bit and exits with the drill bit on the other side of the crossing.
    - c) The drill bit and drill string is withdrawn back through the wash over pipe, leaving the wash over pipe in place.
    - d) A series of tools are connected between the end of the wash over pipe and the main. A fly cutter widens the drilled hole to its final diameter. A barrel reamer smooths the wall of the hole and directs bentonite to the fly cutter for transport of cuttings to the surface. A swivel is installed between the barrel reamer and the main to ensure that no torque is transmitted to the pipe main.
    - e) After the tools are connected between the wash over pipe and the main, the drill rig will rotate and pull the wash over pipe along the

drilled path, with the pipe following slowly behind.

- f) After the pipe is in place, it shall be pressure and leak tested.

B. Drill Path Geometry

1. Contractor is responsible for horizontal and vertical alignment of the pilot drill and final installed pipe. The pilot drill should conform to the pipeline alignment as shown on the Contract Drawings. Contractor shall submit all proposed changes to the vertical alignment shown on the Drawings to the Owner for approval prior to commencing work. Under no circumstances shall installed pipe be at a higher elevation than that shown on the Contract Drawings or vary by more than 2 ½ feet from the horizontal alignment shown on the Contract Drawings.
2. The accuracy of the drill exit point shall be within a 2-½ foot horizontal radius of the design exit point.
3. Entry and exit points shall be located as shown on the Contract drawings.
4. Contractor shall map the location of each pilot drill string joint to a minimum horizontal and vertical scale of 1 inch equals 20 feet. The map shall be provided to the Owner.
5. Should the Contractor exceed the limits described above, a new pilot drill shall be performed at the expense of the Contractor and at no cost to the Owner.
6. If requested by the Owner, Contractor shall provide full explanation of details regarding any technical means, methods or equipment necessary to accomplish the work described herein.

C. Job Conditions

1. Existing Utilities: The Contractor shall be responsible to field locate existing underground utilities in the areas of Work.
  - a) Should uncharted or incorrectly charted piping or utilities be encountered during the work, consult piping or utility owner immediately for instructions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
  - b) Do not interrupt existing utilities serving facilities occupied and used by Owner or others, except when permitted in writing by Owner and then only after acceptable temporary utility services have been provided.
  - c) Coordinate with utility companies for shut-off of services, if required and the lines are active.
2. Use of Explosives: Do not bring explosives onto site or use in the Work. Use

of explosive materials is specifically prohibited.

3. Dust Control: Contractor shall conduct all of his operations and maintain area of his activities, including sweeping and sprinkling of roadways, so as to minimize creation and dispersion of dust.

D. Installation Specialist:

1. Contractor shall provide the full time services of a competent installation specialist during the Directional Drilling to assist in technical matters relating to the Work. He shall advise the Owner on matters to include but not limited to drilling, pipe support, mapping of the pipe location, quality assurance of the Work, safety or other items as necessary.

E. Completion of Work

1. Interior of all pipe and fittings shall be inspected and all dirt, gravel, sand, debris, or other foreign material shall be completely removed from pipe interior. A bulkhead shall be attached to the end of the pipe prior to attaching the swivel and barrel reamer to ensure inside of pipe remains clear during pullback operation.
2. Install all pipes accurately to line and grade shown on the Contract Drawings.
3. A watertight cap shall close the open ends of pipe any time that pipe work is not actively in progress.
4. Field cutting pipe, where required, shall be made with a machine specially designed for cutting piping. Cuts shall be carefully done, without damage to pipe, so as to leave a smooth end at right angles to the axis of pipe. Cut ends shall be tapered and sharp edges filed off smooth.
5. At completion of installing pipe, the pipe shall be stubbed two feet above grade at both ends and capped with watertight cap.

### 3.2 ENVIRONMENTAL CONTROLS

A. Disposal Site:

1. The drilling mud cannot be disposed of on the project site.
2. Off-site disposal of the drilling mud is the Contractor's responsibility.
3. Contractor shall comply with all applicable laws and regulations regarding the transport and off-site disposal of the drilling mud and all excess excavated materials.
4. All costs for proper transport and disposal of drilling mud and all excess excavated materials shall be included in the price bid for the Work.

- B. All operations involving drilling mud shall be controlled and monitored by the Contractor to ensure containment.

1. The Contractor shall establish bermed or sandbagged pits of sufficient size to accommodate the volume of drilling mud anticipated plus a two-foot freeboard. The bermed areas shall be maintained and designed by the Contractor to ensure containment and prevent loss of drilling mud.
  2. Transportation of the disposal materials off-site by public roads shall meet all North Carolina Department of Transportation requirements.
- A. Transportation of materials by barge or scow shall be in accordance with the Corps of Engineers and U.S. Coast Guard requirements. No bottom open vessels shall be allowed.

### 3.5 TRENCH EXCAVATION

- A. Trenches for pipe shall be dug true to line and grade and to the following requirements: Depth of cover shall not be less than 3'-0" for pipe up to 8" in diameter and 3'-6" for pipe 10" and larger in diameter, measured to the top of pipe.
- B. Sides of trenches shall be kept as nearly vertical as possible. They shall be at least 12" and not more than 18" wider at the top of the pipe than the outside diameter of the pipe, plus sheathing where it is necessary. Where paving is to be cut, it shall be cut in advance of trenching 1' wider than the specified width of the trench.
- C. Where soil conditions prohibit vertical walls, the trench width at the bottom and at 1' above the top of the pipe shall be as specified above with the remainder being held to the least possible width greater than that specified. Where soil conditions prevent ditch excavation without excessive widths a suitably reinforced steel trench box shall be employed.
- D. Trench bottoms shall be hand graded to provide uniform and continuous bearing for the pipe along its entire length, with bell holes being dug for pipe bells. No ridges, sags, or undercutting will be allowed. Excess excavating below grade shall be backfilled at the Contractor's expense with suitable material, which shall be thoroughly tamped.
- E. Where the material at grade is unstable, soft, and incapable of supporting the pipe, the trench shall be excavated below grade, and refilled to grade with crusher-run stone or gravel to form a firm foundation for the pipe. Stone shall be compacted and graded to provide a stable foundation and a uniform bearing for pipe. Bell holes shall be provided as in other types of foundations.
- F. Dispose of material excavated from the trench that is unsuitable for backfill material. Provide in place select borrow material to replace unsuitable material for backfilling the trench as directed.
- G. Should ground water be encountered in the bottom of the trench, causing the trench bottom to be unstable, the material shall be excavated below grade sufficiently to allow a bed of crushed rock or gravel to be place in which to bed the pipe. The work shall be done as for unstable foundations. The depth of cut below grade shall be only the minimum amount to accomplish the purpose.
- H. Whenever necessary, the side of the trench shall be braced and rendered secure and

either open or closed sheeting; such sheeting and bracing to be left in place until the trench is refilled to a safe limit, not less than 2' above the top of the pipe. The top portion may then be cut off, but the lower portion shall remain undisturbed. In lieu of sheeting, suitable trench boxes may be employed. All sheeting, bracing, trench boxes, and trench construction methods shall conform to the latest Department of Labor Safety and Health Regulations for construction promulgated under the Occupational Safety and Health Act of 1970.

- I. At all times take necessary precautions in preventing gutters, catch basins, ditches and other drainage facilities from being clogged that might cause flooding conditions and damage to public or private properties.

### 3.6 PIPE INSTALLATION

- A. The pipe shall be carefully handled to prevent damage. Mechanical hoists or other approved methods shall be used in the handling. Depth of cover shall not be less than 3'-0" for pipes 8" in diameter or 3'-6" for pipes 10" and larger in diameter, measured to the top of pipe.
- B. Pipe and appurtenances shall be kept clean and open ends securely plugged when pipe and bell and spigots shall be thoroughly inspected and cleaned prior to lowering into the ditch and care shall be exercised after the pipe is in place to prevent dirt or other extraneous material from getting into the pipe or bells and into the spigot.
- C. Spigots shall be fully seated in the bells and the pipe shall be uniformly bedded on the bottom of the trench for its entire length with bells lying in previously dug bell holes sufficiently large to allow proper bedding and jointing. After joining, a reasonable amount of deflection may be made in the joint. Such deflection shall not exceed the allowable amount specified by the manufacturer for each size of pipe.
- D. Cast iron pipe shall be laid in accordance with the manufacturer's instructions, applicable portions of AWWA Specification C600, and the following:
  1. For mechanical joint pipe, Type II, the rubber rings shall be properly lubricated and spigots and bells cleaned before assembling the joint. Units of bolted joints shall be tightened with special torque limiting wrenches set to provide the proper strain on the bolt, and all nuts tightened to that limit.
  2. Rubber ring joints, Type III, shall be assembled in accordance with the manufacturer's instructions. The bell and spigot shall be absolutely clean prior to the seating of the gasket. The gasket shall be wiped clean, flexed and properly inserted into the socket and seated evenly and properly. Care shall be taken to eliminate any bulges, which might interfere with the proper entry of the spigot. A thin film of lubricant shall be applied to the inside surface of the gasket. Forcing the spigot into the bell until it makes contact with the bottom of the gasket shall then complete the joint. This shall be done by use of a pipe jack and assembly.
- E. PVC pipe shall be installed to all applicable portions of requirements for other pipe material and to the exact instructions of the manufacturer. Adapters shall be

furnished and installed as necessary when connections are made to other types of pipe.

- F. Fittings shall be handled and installed in the same manner as the pipe and all shall be well blocked as hereinafter specified.
- G. Valves shall be carefully handled, cleaned, and checked for operation prior to backfilling. Care shall be taken to insure that no dirt, rock, or other obstacles that would interfere with the valve operation are left in the valve.
- H. A valve box shall be installed with each underground valve. They shall be carefully set, centered exactly over the operating nut and truly plumbed. The base shall be set on brick, so arranged that the weight of the valve box and superimposed loads will bear on the base and not on the valve or pipe. Extension stems shall be furnished where depth of bury places operating not in excess of 4' beneath finished grade.
- I. Fire hydrants shall, in general, be set well back of the curb or ditch line, with the break ring approximately 2" above the finished ground or pavement elevation. A minimum of **four** cubic feet of stone shall be placed under and around the bottom of each hydrant to facilitate its drainage. Hydrants shall be well blocked with concrete and connected back to the main with tie rods as hereafter specified. Each hydrant shall be painted, after installation, with an acceptable paint and of color(s) selected by the Owner. After installation and prior to being placed into service, each fire hydrant shall be covered with a plastic bag to indicate the fire hydrant is not in service.
- J. Valve markers shall be installed for each valve and blow-off. They shall be carefully set with the letters facing the valves and shall be plumb.
- K. Concrete for blocking and protection shall be poured in accordance with the following requirements: All fittings, bends, dead ends, fire hydrants, etc., shall be acceptably blocked with concrete having bearing on undisturbed earth in the side and/or bottom of the trench. No concrete shall be poured or splattered on fitting bells, glands, or bolts.

### 3.7 BACKFILLING

- A. All trash, forms, debris, and other foreign material shall be cleared from around all pipes and structures before backfilling.
- B. Backfilling of trenches shall be completed after the installation of each section of pipe. Backfilling shall be kept up with the pipe laying.
- C. Backfilling around the pipe and to a depth of at least 1' above the top of pipe shall be placed by hand in layers of not over 6". Only select material containing no rocks or other objectionable material shall be used for this portion of the backfill. As fast as the material is placed, it shall be cut under the haunches of the pipe with a shovel and thoroughly compacted with mechanical tamps for the full width of the trench to provide support for the bottom and sides of the pipe. Filling shall be carried up evenly on both sides.
- D. The balance of the backfill shall be placed and tamped to prevent excessive

settlement. If the trench backfill is located under miscellaneous paved areas, areas to be paved, or unpaved streets, the trench shall be backfilled with suitable material free from large stones or clods in 8" layers (loose measurement) and thoroughly tamped and compacted to 95% of maximum as established by AASHTO Specification T99, Method A, with mechanical tampers, so as to avoid future settlement. Where applicable, the compaction shall be acceptable to the Department of Transportation. For trenches located in streets and highways, trench backfill shall be in accordance the Cutting and Replacing Pavement section.

- E. For pipe outside street right-of-way limits, compaction shall be at least 90% of maximum as established by AASHTO Specification T99, Method A.
- F. Excess material shall be promptly removed from the site, and the pavement or road surface cleaned of objectionable material. The pavement and/or road surface shall be cleaned daily with a mechanical broom and/or washed if requested by the Department of Transportation officials.
- G. In unpaved streets and shoulders of roads, the top 6" of trench shall be filled with stone for unpaved streets and well-compacted topsoil for shoulders. In paved areas, the top of the trench shall be filled with the specified base for pavement, well mixed and compacted. Any settlement of backfill below finish grade shall be promptly corrected.
- H. All final subsidence of all trenches and shall leave the same flush with the original ground after all settlement has taken place. Trenches must be protected against scour due to surface drainage. Correct any future settlement within the warranty period.

### 3.8 DUST CONTROL

- A. Control dust throughout the life of the project within the project area and at all other areas affected by the construction of the project. Dust control shall not be considered effective where the amount of dust creates a potential or actual unsafe condition, public nuisance, or condition endangering the value, utility, or appearance of any property.

### 3.9 CUTTING AND REPLACING PAVEMENT

- A. Where pavement is to be cut for installation of pipe or other utilities, the Contractor shall cut it neatly in advance of trenching and shall replace the pavement with base and new pavement.
- B. All pavements shall be neatly cut to a straight edge in advance of trenching. Pavement shall be cut 12" wider than the excavated area on each side. Ragged or irregular edges will not be allowed and work completed with barred edges shall be redone. Concrete pavement shall be sawed with suitable concrete saw cutting equipment.
- C. Trench backfilling shall be done in layers not over 6" thick and thoroughly compacted. Compaction shall be such as to prevent future settlement. Rolling with rubber tired vehicles or track-type equipment will not be allowed. Compaction shall be at least 95% of maximum as established by AASHTO Specification T99, Method

A.

D. Base for pavement shall be crusher run stone for all non-NCDOT maintained streets, HB binder for all secondary highways, and reinforced concrete for all primary highways. All base shall be placed in accordance with the details and/or encroachment permit.

1. Crusher run stone shall be well mixed and compacted by tamping and rolling. Compaction shall be to such degree as to preclude settlement. Crusher run base material shall be placed at the same time that the trench is backfilled. Backfilling to top of the ditch, to be cut out and replaced with base material at a later date, will not be allowed.
2. Crusher run base for highway pavement and adjacent drives shall be 8" of stone, stabilized with 5% Portland Cement. It shall be thoroughly mixed prior to compacting.
3. Crusher run base for non-highway pavement and drives shall be 8" of stone without the addition of cement.
4. Binder base for secondary roads shall be a minimum of 6" HB binder conforming to the Department of Transportation specifications.
5. Concrete base shall consist of 8" of concrete, reinforced with #4 reinforcing steel bars placed at 8" on center in the transverse direction and #4 tie bars in the longitudinal direction. Concrete shall be designed to produce a compressive strength of 3000 psi at 28 days.
6. Pavement shall be replaced with the same type of pavement that exists prior to cutting and shall consist of either bituminous surface course (double treatment), 2" of hot plant mix asphaltic concrete, or 8" of Portland Cement concrete; all conforming to specifications of the Department of Transportation for each type.
  - a) All pavements shall be repaired within the same week that it is cut.
  - b) For asphalt pavement or bituminous surfacing, the entire area to be resurfaced (including edges of existing pavement) shall be primed with an acceptable asphalt prime coat just prior to placing new pavement.

### 3.10 REMOVING AND REPLACING SIDEWALK

A. Where pipe is to be placed under existing concrete sidewalk, the concrete shall be removed in construction units unless their length is more than 10', in which case the concrete shall be cut as specified in this section. The backfill shall be thoroughly compacted for the entire depth of the trench.

- B. The sidewalk shall be replaced with 3000 psi concrete, 4" thick, except for driveways where it shall be 6" thick. The concrete shall be placed monolithic and dressed off with a wooden float, brush and edging tool. Where pipe is to be placed under concrete walk it shall be done by tunneling.

### 3.11 CONNECTIONS TO EXISTING MAINS

- A. Wet taps, using tapping sleeves and valves, shall generally be made; except as otherwise approved in which case the main shall be cut and the connections made with fittings and valves. In no case shall the water be shut off or the fire hydrants or gate valves operated in the existing systems without the expressed permission of the Owner.

### 3.12 INSPECTION AND ACCEPTANCE

- A. All work shall be subject to inspection and approval prior to final acceptance and payment. Final acceptance shall be contingent upon the following:
  - 1. All pressure and leakage tests shall yield satisfactory results.
  - 2. All bacteria samples shall be negative.
  - 3. Final cleanup will be satisfactorily performed and all defects in trench settlement, pavement patches or other deficiencies will be promptly corrected.
  - 4. All complaints are satisfactorily resolved.
  - 5. Receipt of a NC licensed Professional Engineers certification in writing that construction has been completed according to plans and specifications previously submitted and approved by the State.
  - 6. Receipt of as-built drawings of the project in the form of CAD file, hard-copy and PDF sealed by the engineer.
  - 7. Receipt of Affidavit, Deed of Dedication, and 18-Month Warranty.

**END OF SECTION**

**SECTION 33 3000**  
**SECTION 02 - 2005**  
**PLURIS SEWER SPECIFICATIONS**

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## Part I      DEFINITIONS, ABBREVIATIONS, AND GENERAL REQUIREMENTS

When standards are referred to in this design criteria document, the most recent revision shall be applicable. This document addresses the collection and transmission of wastewater, not the treatment of wastewater.

Pump stations, force mains, and all related appurtenances shall be manufactured, designed, constructed, and tested in accordance with accepted standards, good engineering practice, and in complete compliance with the most current state regulations, as well as the North Carolina Department of Environmental Quality ("NCDEQ") Minimum Design Criteria.

These standards apply to gravity collection sewers, pump stations, force mains, and appurtenances.

### 1.      STANDARD DEFINITIONS a.      DEFINITIONS

Wherever used in this Manual, the following terms shall have the meanings indicated, which shall be applicable to both the singular and plural thereof. There are other terms used in this document, which are defined in the sections to which they apply.

*Applicant* - Entity who is financially responsible for the proposed sewer collection system construction or modification, and who shall maintain operational responsibility of said system unless fee simple title is granted to PLURIS, Hampstead, LLC (PLURIS).

*Application* - Form or forms provided by NCDEQ and completed by the Engineer of Record and Applicant providing pertinent information regarding the design and the proposed construction or modification of sewer collection facilities. It includes all required associated documents.

*Approved Plans* - Sewer system improvement plans that have been reviewed by and received the approval of PLURIS and/or the appropriate state and local agencies.

*Approving Authority* - Authorized agent of PLURIS, who shall be responsible for approving plans and granting service.

*Contract Documents* - Refer to the project plans and specifications for sewer system improvements.

*Contractor* - The person, business, or corporation responsible for the performance of sewer system construction work.

*Design Population* - The population figure is obtained by multiplying the effective population figure by the proper factors for determining the design flow.



*Developer* - The person(s) or corporation(s) financially responsible for the design and construction of a development for which wastewater service by PLURIS will be requested.

*Documents* - All drawings, graphs, charts, calculations, compilations of data, writings, photographs, audio or video recordings, or other such records from which project pertinent information can be obtained, extracted, or translated in a usable form.

*Engineer of Record* – A professional engineer licensed to practice in the state of North Carolina and responsible for performing the design and preparing the drawings and specifications for the proposed sewer collection system construction or modification(s) and construction administration. They certify the completion of such construction or modification(s) in accordance with the approved plans, specifications, and permits. The Engineer of Record shall have experience and knowledge regarding the design and operation of sewer improvements.

*Manual* - Refers to all applicable standards, specifications, standard details, and policies contained in or referenced by this document.

*Permit (NCDEQ Permit)* - Written document issued by NCDEQ authorizing the construction or modification of sewer infrastructure.

*Permit Period* - Duration during which an NCDEQ permit is valid, commencing on the date of permit issuance by the Approving Authority and, unless suspended, modified, or revoked for cause, shall be valid for the succeeding twelve (12) months or until work is complete, accepted, and certified by the Engineer of Record, whichever occurs first.

*Person* - Individuals, sole proprietorships, partnerships, limited liability corporations, corporations, professional associations, firms, joint ventures, businesses, institutions, municipal or other local government subdivisions, governmental agencies, or any other corporate or political body, for profit or nonprofit.

*Pipe Trench* - The following terms are used in reference to excavation and backfill for pipes:

*Bedding* - The portion of the pipe support structure bounded by the foundation or undisturbed trench bottom, the trench walls, and the bottom of the pipe.

*Final Backfill* - The portion of the backfill lying above the initial backfill.

*Foundation* - The portion of the pipe support structure bounded by the undisturbed trench bottom, the trench walls, and the pipe bedding.

*Haunching* - The portion of the pipe support structure bounded by the bedding, the trench walls, the outside of the pipe, and a horizontal plane having an elevation equal to that of the spring line of the pipe.

*Initial Backfill* - The portion of the backfill lying above the spring line (midline) of the pipe and below a horizontal plane having an elevation that is one (1) foot above the top of the pipe.

*PLURIS Sewer Collection System* - Part or portion of the facilities owned by PLURIS, which are used to collect and carry wastewater to the treatment works and end at the sewer service lateral cleanout or other designated connection.

*PLURIS* - PLURIS Hampstead, LLC

*Record Drawing* - A complete set of drawings, consisting of one (1) hard copy on bond paper and one (1) electronic copy in PDF format that can be printed out but not modified and that shows actual installed or constructed conditions. Controlled location shall be based upon North American Datum of 1983. Vertical control shall be based upon North American Vertical datum of 1988 unless no such control is available within 2,000 feet of the property, in which case the datum used in setting the control monument will be used.

*Required Fee* - Fees levied by PLURIS as established in adoption of PLURIS User Rates and Application Fee for construction observation, permit application, modification, or renewal, as well as administrative review.

*Service Lines* - Small pipelines (sewer lines six [6] inches or less) connecting homes and buildings to the collection system.

*Sewer Collection System* - The meaning as stated in North Carolina General Statute 143-213 (15) in its most current amended form.

*Standards* - Where this Manual makes a reference to published standards, including but not limited to ASTM, ANSI, and AWWA, the latest revisions of such standards shall apply.

*Sewer Service Area* - Area designated as the franchise area by the North Carolina Public Utilities Commission (the land area within which sewer service is or will soon be available).

## **2. STANDARD ABBREVIATIONS**

Several specific standards and practices are referenced in these minimum design criteria. The following acronyms and abbreviations shall be used when referring to these standards and practices for purpose of enhancing the clarity of this document:

### **A**

AASHTO - American Association of State Highway Transportation Officials  
ABC - Aggregate Base Course

ACI - American Concrete Institute

ANSI - American National Standards Institute

API - American Petroleum Institute

ASTM - American Society for Testing and Materials  
AWWA - American Water Works Association

### **D**

DIP - Ductile Iron Pipe

### **E**

EA - Environmental Assessment

EEP - Environment Enhancement Program  
EIS - Environmental Impact Statement

### **F**

FEMA - Federal Emergency Management Agency  
FIRM - Flood Insurance Rate Map

FONSI - Finding of No Significant Impact

### **G**

Gal/Person - Gallons Per Person  
Gal/Unit - Gallons Per Unit

Gal/Acre - Gallons Per Acre

GPD - Gallons Per Day

GPM - Gallons Per Minute

### **H**

HDPE - High Density Polyethylene  
HI - Hydraulic Institute

## **I**

I/I - Inflow and Infiltration

## **M**

MGD - Million Gallons Per Day

## **N**

NC - North Carolina

NCAC - North Carolina Administrative Code

NCDA - North Carolina Department of Administration

NCDEH - North Carolina Division of Environmental Health

NCDOT - North Carolina Department of Transportation

NCDWQ - North Carolina Division of Water Quality NEC - National Electric Code

NEMA - National Electric Manufacturer's Association NFPA - National Fire Protection Association

NPDES - National Pollutant Discharge Elimination System NPSHA - Net Positive Suction Head Available

NPSHR - Net Positive Suction Head Required

## **O**

OSHA - Occupational Safety and Health Administration

## **P**

PPI - Plastic Pipe Institute psi - Pounds per square inch

psig - Pounds per square inch gauge PVC - Polyvinylchloride

## **S**

SF - Safety Factor

## **T**

TDH - Total Dynamic Head

## **U**

UL - Underwriters Laboratories

USCE - United States Corps of Engineers

### 3. GENERAL REQUIREMENTS

- a. Sewer Permits – Prior to submitting the application to NCDEQ, PLURIS will need to issue a flow acceptance letter for the additional flow to systems owned, operated, and maintained by an entity other than PLURIS. PLURIS will review and approve all plans for the proposed sewer improvements prior to submission to NCDEQ for permitting. In the case of extensions that will be dedicated to PLURIS, the Applicant will provide a completed application in the name of PLURIS for the proposed work.

The following situations require approval and are permitted by the state of North Carolina (NCDEQ - DWQ), regardless of ownership (in addition to PLURIS approval):

- i. Outfalls into a basin where sewer service has not yet been provided.
  - ii. Low pressure sewer systems or STEP systems.
  - iii. Projects involving environmental assessments.
  - iv. Any collection system where a variance from state regulations is required.
- b. All PLURIS Design Standards shall be incorporated and become an integral part of the Plans, Specifications, and Contract Documents submitted for review and approval. Deviations must be noted in writing and receive written approval from PLURIS prior to final Contract Document approval.
- c. The Contract Documents shall ensure that all structures, pavements, utilities, and other facilities that could be damaged because of project work are replaced or repaired in a manner that meets the approval of PLURIS or any governing bodies having jurisdiction.
- d. No connection to or alteration of any existing facilities owned or maintained by PLURIS shall be permitted without the express permission of PLURIS and, where required, the presence of PLURIS's representative, except as directed by PLURIS.

Where a connection or alteration of any existing facilities is approved, the connection or alteration shall conform to the standards of this Design Manual for new installations.

- e. All sewer extensions to be operated and maintained by PLURIS, in addition to any extensions not owned by PLURIS, shall be designed and built in accordance with this Design Manual and all applicable state and local regulations.

#### 4. SUBMITTALS AND GUIDELINES

##### a. REQUIRED COPIES OF CONTRACT DOCUMENTS FOR PLURIS APPROVAL

The Engineer of Record should submit to PLURIS one (1) set of Contract Documents, including pertinent calculations, plans sheets, specifications, and all required supporting documentation such as (but not limited to) Watershed Classification Statements and Certificates of Public Convenience. The Engineer of Record shall have applied for applicable permits to NCDEQ and have paid associated fees for a preliminary review prior to submission of all Contract Documents necessary. These documents shall be presented in duplicate to PLURIS as an entire submission package for review.

PLURIS shall review such plans, make appropriate notes, and return the "redlined drawings" to the developer's Engineer of Record marked so that the necessary revisions can be made, and the Contract Documents can be revised. Upon review by PLURIS of the "red lines," PLURIS may request to meet with Applicant to discuss comments. All comments shall be addressed to comply or an explanation of reasons for not complying must be provided and approved by PLURIS.

The submitted plans must meet PLURIS design requirements. If plans or specifications do not meet PLURIS design requirements, PLURIS may elect to return the submittal package until such time the plans and specifications meet PLURIS design requirements (unless a variance has been given and a copy of such variance included with submission). Any applicable review fees paid to PLURIS are nonrefundable, and applicable fees are required for each review submittal.

The revised plans, permit applications, fees, and other supporting documentation shall be submitted for the approval by PLURIS and the appropriate state agencies, as appropriate.

##### b. ENGINEERING DESIGN CALCULATIONS & REPORTS

All Contract Documents submitted to PLURIS for approval shall be accompanied with the necessary design calculations as specified herein or requested by PLURIS. The calculations and any reports shall be prepared by the Engineer of Record.

All design calculations based on data not contained therein shall be referenced to the source. The calculations shall be submitted in duplicate, clearly referencing the project and presented in a neat, orderly, and logical procedure. All reports prepared by subconsultants shall list the assumptions made in the report preparation.

##### c. SEWER DESIGN CALCULATIONS

Sanitary sewer, force main, and pump station improvement calculations shall demonstrate adequate capacity to serve the entire contributing area. The calculations for the gravity mains shall be based on Manning's Formula, using a roughness ("n" factor) appropriate for the material in question. This n factor must be supported by published data from the manufacturer or other industry publication.

## 5. CONCEPTUAL PHASE

### a. GENERAL

The developer's Engineer of Record and/or Developer shall become familiar with the sewer improvement policies of PLURIS prior to making conceptual plans for developments that require sewer service.

### b. INITIAL CONFERENCE

Prior to finalizing any plans for sewer collection system improvements, the Developer and/or the developer's Engineer of Record shall consult with PLURIS' Authorized Agent to determine whether an initial conference will be necessary prior to the submission of plans for approval. If the scope of the proposed development is such that an initial conference will be beneficial prior to the development of final plans and specifications, considered and labeled as "Final Plans - Not Released for Construction" on the plans, the Developer will request scheduling of an initial conference. The Developer shall present the following:

- i. Conceptual Plans: Submit two (2) copies of conceptual subdivision plans or site plans at a scale of 1-inch equals 200 feet (or larger scale) showing the proposed layout of the sewer extensions. The conceptual plans should show all proposed pipelines and sizes, manholes, valves, clean outs and pump stations, and the nearest existing sewer facilities to which the proposed new improvements will be located or connected. All proposed easements shall be shown. Provide a sketch of improvements and projected inverts within service area for the sanitary sewer. All Conceptual Plans are to include at least one (1) page with only the water and wastewater utilities, manholes, mains, and services, etc... They should be in color to reflect their content: green for identifying wastewater and blue for identifying water.
- ii. Design: Provide copies of preliminary engineering design calculations used to determine estimated wastewater demands used to size line and pump station requirements, including expected initial and future populations to be served. The probable character of the wastewater generated should be provided.
- iii. Estimated Time Schedules: Submit an estimated time schedule identifying the expected dates of completion of the final plans and specifications and expected beginning and completion dates of construction.

## Part II      **GENERAL SPECIFICATIONS**

### 1.      **CLEARING**

- a. All clearing will follow the guidelines for erosion control per an NCDEQ approved and permitted erosion control plan if one is required. Projects that do not require an approved plan will follow all industry standards for erosion control. All disturbed areas will be stabilized within 15 days of the end of work in that area. Stabilization of disturbed areas should follow the seeding guidelines set forth in Specification 3.

### 2.      **EXCAVATING, GRADING, TRENCHING, & BACKFILLING**

- a. General

The contractor shall furnish all labor, equipment, supplies, and materials and perform all operations in connection with the excavations, grading, and backfilling, including borrow for drainage structures, curb and gutter, sidewalks, driveways, pavements, slopes, storm drains, water and sanitary sewer lines. This also includes all hauling, wetting, rolling, and other operations pertaining thereto within the clearing limits - complete, in strict accordance with this section of the specifications and all applicable NCDEQ approved drawings, plans and permits.

- b. Existing Conditions

Every reasonable effort should be made to provide accurate information on existing site conditions. The Contractor should become familiar with the site and satisfy himself as to the scope of the work involved and the materials to be encountered.

c. References

- i. ASTM C33 - Standard specification for concrete aggregates
- ii. ANSI/ASTM C136 - Sieve analysis of fine and coarse aggregates.
- iii. ANSI/ASTM D698 - Tests for moisture-density relations of soils and soil-aggregate mixture using 5.5 lb. (2.49 kg) rammer and 12-inch (305 mm) drop.
- iv. ANSI/ASTM D1556 - Density of soil in place by sand-cone method.
- v. ASTM D2487 - Classification of soils for engineering purposes.

d. Products - Soils

- i. General: Use soils free of organic matter, refuse, rocks, and lumps greater than 2 inches in diameter and other deleterious matter.
  1. Backfilling Materials: Suitable material, when used as backfill in paved areas, shall be capable of being compacted as specified in paragraph "Compaction and Testing" of this section of these specifications.
    - a. Type 1 Material: Excavated material from the trench or materials from other sources that are free from large clods, roots, or stones larger than 1 inch may be used as initial backfill in trenches.
    - b. Type 2 Material: Excavated material from the trench or materials from other sources that are free from large clods, roots, or stones larger than 2 inches may be used as final backfill in trenches.
- ii. Classification: For this specification, soils to be used as fill material are grouped into five classes according to soil properties and characteristics.
  1. Class I - Angular, 6 - 40 mm (1/4 to 1 1/2 in.), graded stone, including several fill materials that have regional significance such as coral, slag, cinders, crushed stone, crushed gravel, and crushed shells.
  2. Class II - Coarse sands and gravels with maximum practical size of 44 mm (1 1/2 in.), including variously graded sands and gravels containing small percentages of fines, granular, and non-cohesive, either wet or dry. Soil types of GW, GP, SW, and SP are included in this class.
  3. Class III - Fine sand and clayey gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures. Soil types of GM, GC, SM, and SC are included in this class.

- 4. Class IV - Silt, silty clays, and clays, including inorganic clays and silts of low to high plasticity, and liquid limits. Soil types of MH, ML, CH, and CL are included in this class. These materials are not recommended for bedding, pipe haunching, or initial backfill.
- 5. Class V - This class includes the organic soil, OL, OH, PT, as well as soils containing frozen earth, debris, rocks larger than 40 mm (1 ½ in.) in diameter, and other foreign materials. These materials are not recommended for bedding, pipe haunching, or initial backfill.
- iii. Topsoil: Natural, friable soil free of subsoil, stumps, rocks larger than 2 inches in diameter, weeds, and other material detrimental to plant growth.
- iv. Granular Fill: Granular fill under floor slabs shall be Class I material.
- v. Structural Fill: Fill material placed inside the line of the building foundation or slab shall be Class I or II.
- vi. Fill Beneath Pavement: Fill material used beneath pavement and for road shoulders shall be Class II or III.
- vii. General Fill: General fill material not otherwise specified shall be Class II or III.
- viii. Trench Backfill: Material used for bedding, pipe haunching, and initial backfill shall be as specified hereinafter.
  - a. Crushed Stone: Crushed stone shall be size no. 57, washed stone. If fines are insufficient, stone screenings shall be added to the extent required to stabilize it in the trench.
  - b. Concrete: Concrete placed thrust blocks shall be 3,000 psi or greater, 28-day concrete and shall not encase the fittings or bolts.

### 3. EXECUTION

#### a. General

- i. Familiarization: Prior to commencement of the earthwork, become thoroughly familiar with the site, the site conditions, and all portions of the work specified in this Section.

#### b. Surface Preparation

- i. Clearing: Areas designated for clearing and required for construction operations shall be cleared of trees, brush, structures, and other materials. Trees that are to remain shall be protected during clearing operations and subsequent work.

- ii. Grubbing: Roots, stumps, and other materials shall be grubbed from the cleared areas to a depth of at least 18 inches. Tree stumps shall be grubbed in their entirety, including tap roots where applicable.
  - iii. Topsoil: Strip existing topsoil to a depth of 4 inches from areas to be excavated or graded. Stockpile the topsoil in a suitable area for use during final grading operations. Protect the topsoil from excessive erosion.
  - iv. Unsuitable Material: Remove sod, muck, or other unsuitable material to firm subsoil in areas designated for filling or grading operations.
  - v. Disposal: Trees, stumps, roots, rubbish, unsuitable soil, or other material resulting from surface preparation shall be removed from the site by the Contractor and disposed of.
- c. Excess Water Control
- i. General: Grade and maintain all areas of the site to preclude surface runoff into excavations and prevent ponding of water.
  - ii. Dewatering: Excavations should be kept free of surface water and/or groundwater. Provide and always maintain the necessary means and devices to prevent water from entering the excavations and to remove all water entering the excavations at no additional cost to the owner.
  - iii. Softened Subgrade: Remove all soil softened or eroded by the presence of water and replace with suitable backfill material.
- d. Excavation
- i. Excavation shall be accomplished in accordance with the grades and lines as established by the applicable plans and as required by the work to be performed. Excavation shall include the removal and replacement of all asphalt, concrete, curb, rock, earth, fences, trees (as directed by the Engineer of Record), shrubs, and other materials as applicable. The contractor will exercise care to prevent undercutting lower than the required subgrades. All materials from excavation, considered as suitable by the Engineer of Record, shall be used as fill wherever required, and the Contractor shall arrange work so that this usage of excavated materials will be possible. Unsuitable and surplus materials from excavation, if any, shall be disposed of by the Contractor at their expense. All areas of the site shall be graded and always maintained to prevent surface runoff from draining into the excavations and to prevent ponding of water therein.
  - ii. Excavated materials not required for topsoil, fill, or backfill shall be removed from the site of the work by the Contractor, but none shall be deposited on private property without written consent of the private property owner.

- iii. Unsuitable Materials: Unsuitable materials encountered in an excavation shall be removed as directed by the Owner's representative, backfilled with suitable material, and compacted. Unsuitable materials include organic soils, muck, soft and compressible silts, and clays and running sands.
  - iv. Undercutting: Undercutting, unless authorized by the Engineer of Record, shall be replaced and compacted, as specified in section f (Fill and Compaction), at the Contractor's expense. If the material, after excavation to subgrade, is found to be soft, spongy, or pumping and thus unfit for use as subgrade, such unsuitable material shall be removed to a depth as directed by the Engineer of Record, and the subgrade shall be brought to proper elevation by filling with suitable material from excavation or from an approved borrow site.
  - v. Borrow: The Contractor will supply all borrow necessary and will provide all labor and equipment necessary to dig and haul such borrow. The placing of borrow shall be as provided for section f (Fill and Compaction).
- e. Preparation of Subgrade

General: Upon completion of site preparation and excavation, scarify to a depth of 12 inches and compact as specified. For areas to receive fill, the compacted subgrade shall be scarified to a depth of 4 inches prior to placing the fill.

f. Fill and Compaction

- i. General: When and where existing plans and grades require the use of fill to reach the required elevation, the Contractor shall deposit suitable material from previously excavated areas. Such material shall be free from debris, roots, trash, stones, or other harmful substances and shall be spread in successive layers of loose material not more than 8 inches in depth. Each layer shall be spread uniformly by motor grader or other approved device and rolled with an approved tamping or three-wheeled power roller until thoroughly compacted to 90% of maximum density obtained at optimum moisture content, as determined by the AASHTO Standard Method T-180. When any portion of the fill is constructed on an old roadbed, the existing surfaces shall be scarified and manipulated as directed by the Engineer of Record so that, when compacted, it shall have a uniform density, as specified in this section. Fills shall be shaped and always maintained during their construction to prevent an accumulation of standing water in the event of rain.
- ii. Moisture Conditioning: Moisten or aerate the subgrade and fill material as required to obtain proper compaction.
- iii. Structural Fill: Compact the subgrade and fill to a minimum of 98%, ASTM D698 (Standard Proctor) maximum density at optimum moisture content.
- iv. Granular Fill: Place granular fill on compacted, scarified fill or subgrade and compact to a minimum of 100%, ASTM D698, maximum density at optimum moisture content.

- v. Pavement Areas: Compact the subgrade and fill material beneath paved areas and shoulders to a minimum 100% ASTM D698 maximum density at optimum moisture content.
  - vi. Landscaped Areas: Compact the subgrade and fill to a minimum 98% ASTM D698 maximum density at optimum moisture content. Compact topsoil to 85% ASTM D698 maximum density at optimum moisture content.
- g. Finish Grading
- i. General: Perform finish grading to the lines and grades shown on the drawings. Finished grades should be smooth and uniform and provide positive drainage.
  - ii. Tolerances:
    - a. Rough Grade Plus or minus 0.1 foot
    - b. Finish Grade Plus or minus 0.1 foot
  - iii. Topsoil: The top 4 inches of soil in landscaped areas shall be topsoil.
  - iv. Protection: Protect areas that have been graded from equipment traffic.
- h. Trenching, Backfilling, and Compaction for Utility Systems
- i. General: Refer to specific utility sections in these specifications for installation requirements. Trench, backfill, and compact as specified except as modified herein.
  - ii. Trenching: Trench widths at and below the top of the pipe shall be the minimum necessary for proper installation. Trench banks above the top of the pipe shall be as vertical as practicable. Over depth excavation shall be backfilled with Class I material and compacted. The Contractor shall provide, at the contractor's expense and as directed by the Owner's representative, special bedding material or concrete encasement as may be necessary due to over-width excavation.
  - iii. Depth: Trench to the lines and grades shown on the drawings. Where elevations are not shown, trench to a depth sufficient to provide at least 36 inches of cover above the top of the pipe, unless otherwise specified. Grade trenches to provide a constant slope free of sags and high spots.
  - iv. Dewatering: Keep trenches free of water. Include cost of dewatering in unit price bid for pipe. No additional payment for this item is permitted.
  - v. Trench Bracing: Properly brace, sheet, and support trench walls as soil conditions indicate and in strict conformance with all laws and OSHA regulations. Provide adequate bracing and shoring to protect adjacent improvements. Contractor shall provide certifications for all premanufactured trench bracing devices prior to any excavation activities.

- vi. Bedding, Pipe Haunching, and Initial Backfill: Tamp to provide firm, even bedding. Excavate bedding material to match the shape of the bottom of the pipe and bell, as detailed in the drawings. Place haunching material to provide full bearing around the bottom of the pipe. Place bedding haunching and initial backfill as specified below.
- vii. Pipe Bedding:
  - 1. PVC C-900 Gravity Main - Provide six (6) inches of Class I bedding material compacted to 98% ASTM D698 density. Haunching material shall be Class I material compacted to 98% ASTM D698 density. Haunching of pipe from invert to spring line shall be by hand placement to ensure material is worked under haunch. Initial backfill shall be Class I to top of pipe (washed #57 stone preferred).
  - 2. DIP and C-900 PVC Gravity Main - Provide six (6) inches of Class I bedding material compacted to 98% ASTM D698 density. Haunching material shall be Class I material compacted to 98% ASTM D698 density. Haunching of pipe from invert to spring line shall be by hand placement to ensure material is worked under haunch. Initial backfill shall be Class I to spring line of pipe Class I, II, or III material to top of pipe.
  - 3. Pressure Main PVC C-900 or DIP - Provide six (6) inches of Class I or II bedding material compacted to 98% ASTM D698 density. Haunching material shall be Class I or II material compacted to 98% ASTM D698 density. Haunching of pipe from invert to spring line shall be by hand placement to ensure material is worked under haunch. Initial backfill shall be Class I or Class II to top of pipe Class I, II, or III material from top of pipe to 6 inches above pipe.
  - 4. Service Pipe (C-900) - Provide six (6) inches of Class I or II bedding material compacted to 98% ASTM D698 density. Haunching material shall be Class I or II material compacted to 98% ASTM D698 density. Haunching of pipe from invert to spring line shall be by hand placement to ensure material is worked under haunch. Initial backfill shall be Class I or II to top of pipe.
- viii. Backfill: Backfill the remainder of the trench in accordance with paragraphs 2d (Products-Soils) and f. (Fill and Compaction) of this section. Backfill from embedment zone to surface grade may be by hand or mechanical placement. Trench backfills shall be compacted in 8-inch lifts.
- ix. Foundation: Firm foundation support materials shall be required in wet, yielding, and mucky locations and shall be constructed by removal of wet, yielding, or mucky material and its replacement with sufficient Class I material to correct the instability. In areas where foundation is required, bedding shall be class I only.
- x. Backfilling in Traffic Areas (highways, paved streets, paved parking lots, alleys, driveways,

highway, and street shoulders)

1. Initial Backfilling of Pipe (Ordinary Bedding for DIP Pipe)
  - a. After preparing the trench for ordinary bedding as described under h. (Trenching, Backfilling and Compaction for Utility Systems) of this section, this portion of the pipe trench shall be backfilled with suitable materials (Type 1) under and around the pipe, carefully deposited in uniform layers on both sides of pipe, and compacted by hand or pneumatic tampers until backfill reaches one (1) foot above top of pipe. The depth of backfill layers shall be six (6) inches maximum. Each layer of material shall be compacted to a dry density 95% of the maximum determined by the Standard Proctor Compaction Test.
  - b. When crushed stone is used, the initial backfill of suitable materials will not be required.
  - c. The tampers shall be proper sized to operate between trench wall and pipe without damaging the pipe.
2. Initial Backfilling of Pipe (Crushed Stone Encasement for PVC pipe, DIP in unstable or wet conditions)

This portion of the pipe trench shall be backfilled with crushed stone to provide crushed stone encasement.

3. Backfilling Trench to Subgrade After Initial Backfilling (Suitable Materials)
  - a. After initial backfilling has been compacted as specified above, backfill the remainder of the trench in compacted layers not to exceed twelve (12) inches using a mechanical tamper up to the bottom elevation of the pavement structure with suitable materials (Type 2) to be a dry density 95% of the maximum determined by the Modified Proctor Compaction Test.

i. Field Quality Control

- i. Field inspection, sampling, and testing will be performed per owner's instructions.
- ii. For areas where paving is disturbed and must be reinstalled, an independent geotechnical engineer and testing laboratory shall perform sufficient tests and inspection procedures, to the satisfaction of the Engineer of Record, both in the field and lab to ensure that the provisions of this specification are met. The Contractor shall pay for all testing. The Engineer of Record shall approve the testing lab. After testing is completed and reports are provided, all subgrades below the paving will be examined by the Engineer of Record before any paving is authorized. The responsibility of the geotechnical engineer and testing laboratory is to promptly, and accurately report the results of their tests and inspections to the Engineer of Record. In addition, the geotechnical engineer must work in coordination with the Contractor, in performing all tests required. The geotechnical engineer's reports must state whether the results comply with contract requirements. The testing and control firm shall deliver all its reports to the Engineer of Record with a copy to the Contractor.

## 2. SEEDING AND STABILIZATION OF DISTURBED AREAS

- a. The seeding and stabilization of all disturbed areas shall conform to the NCDEQ approved soil erosion plan and permit. If an approved plan is not required, all disturbed areas shall be seeded and stabilized per the latest edition of the *Erosion and Sediment Control Planning and Design Manual*.

## Part III SUBMITTALS

1. **GENERAL:** Before any work is started at the job site, the Contractor shall make submittals to the Engineer of Record and PLURIS in accordance with the requirements of this section. The Contractor shall be responsible for preparing a progress or work schedule for the project. The Contractor shall process the shop drawings for all materials required to the Engineer of Record and PLURIS, and the Contractor shall be responsible for timely submission in accordance with the shop drawing schedule, which is included in the overall progress or work schedule as described in this section.
2. **SUBMITTALS**
  - a. Submittals are defined as shop drawings, diagrams, illustrations, schedules, performance charts, brochures and other data prepared by each contractor that illustrate how specific portions of the work shall be fabricated and/or installed.
  - b. Shop drawings are not part of the Contract Documents but are a supplementary means of communication to assist in understanding what each Contractor proposes to provide and to establish whether what is intended to be installed conforms to the drawing and specifications.
  - c. In the instance of a substituted item, the Contractor shall verify that it will fit into the space allocated to the originally required item, giving due regard to all other trades' requirements. Where modifications to the Plans and Specifications are proposed, the Contractor must indicate such deviation in writing in the submittal.
3. **SUBMITTAL PROCEDURES:** All shop drawings shall be delivered to the Engineer of Record and PLURIS. The Engineer of Record and PLURIS will screen shop drawing submittals to ensure that the shop drawings have been properly certified and identified. If they are submitted properly, the Engineer of Record will review the items.
4. **CATALOG SHEETS:** For standard manufactured items considered by the Engineer of Record and PLURIS as not requiring special shop drawings, each Contractor shall submit three (3) copies of the manufacturer's catalog sheets showing illustrated cuts of the items to be furnished, scale details, sizes, dimensions, performance characteristics, capacities, wiring and control diagrams, and all other pertinent information.

## 5. SHOP DRAWINGS

- a. Each contractor will submit for review three (3) white prints of shop and working drawings of materials fabricated for a specific contract and of equipment and materials for which such drawings are specifically requested.
- b. Prior to submitting drawings to the Engineer of Record and PLURIS, the Contractor shall check thoroughly all such drawings are satisfactory that the subject matter conforms to the Plans and Specifications in all respects. Drawings that are correct shall be marked with the date, checker's name, and certification of the Contractor's approval and then shall be submitted to the Engineer of Record and PLURIS. Any shop drawings submitted without the Contractor's certification will be returned without review.
- c. Shop drawings shall show the principal dimensions, including but not limited to weight, structural, and operating features; performance characteristics and wiring diagrams; space required; clearances; type and/or brand of finish or shop coat; and grease fittings, depending on the drawing. When it is customary to do so, when the dimensions are of particular importance, or when so specified, the drawings shall be certified by the manufacturer or fabricator as correct.
- d. When so specified or if considered by the Engineer of Record and PLURIS to be acceptable, the manufacturer's specifications, catalog data, descriptive matter, and illustrations may be submitted for review in place of shop and working drawings. In such a case, the requirements shall be as specified for shop and working drawings, to the extent possible.
- e. The Contractor shall be responsible for the prompt submission of all shop and working drawings in accordance with the shop drawing schedule so that there shall be no delay to the work due to the absence of such drawings.
- f. No material shall be purchased or fabricated until the required construction shop and working drawings have been submitted and reviewed. All materials and work involved in the construction shall then be as represented by said drawings.
- g. Only drawings that have been checked or corrected by the fabricator should be submitted to the Contractor by subcontractors and vendors. Prior to submitting drawings to the Engineer of Record and PLURIS, the Contractor shall check thoroughly all such drawings to ensure that the subject matter thereof conforms to the drawings and specifications in all respects. Correct drawings shall be marked with the date, checker's name, and indication of the Contractor's approval, and then shall be submitted to the Engineer of Record and PLURIS; other drawings shall be returned for correction.
- h. The Engineer of Record's and PLURIS's review of shop and working drawings will follow a general check made to ascertain conformance with the design concept and functional result of the project and compliance with the information given in the Plans and Specifications.

The Contractor is responsible for details and accuracy, for conforming and correlating all quantities and dimensions at the job site, for information that pertains to the fabrication processes or to techniques of

construction, for coordination of the work of all trades, and for timely delivery of all materials so that the project will not be delayed.

## **Part IV**      **Record Drawings**

### **1.      RECORD DRAWINGS**

Certified, surveyed record drawings ("as-built" plans), sealed by a North Carolina Licensed Professional Land Surveyor or Professional Engineer (engineer seal required for profiles), shall be furnished to PLURIS by the Engineer of Record (or Developer where applicable) upon completion and acceptance of the infrastructure by PLURIS. Record drawings should, at a minimum, reflect all information found on the approved plans with all pertinent revisions and field changes.

For gravity sewer and force main projects, the as-built plans shall include accurate information regarding pipe size, pipe material, pipe length, manhole construction (size of manhole, invert, rim, alignment, location), services, cleanouts, and pump stations along with any relevant rights-of-way, property boundaries, and easements. Plans shall also include sewer profiles showing any utility crossings along with the aforementioned information. Recorded drawings shall also include at least one-color page with only the water and wastewater utilities, manholes, mains, and service, etc.... They should be in color to reflect their content: green for identifying wastewater and blue for identifying water.

For pump station projects, the as-built plans shall include accurate information regarding interior and exterior pipe sizes, material, and length, as well as all structural dimensions of the pump station, all electrical equipment (make and model), pump information (make, model, and impeller size), and site layout information. Both plan view and section view drawings are required on the as-built plans.

### **2.      DIGITAL INFORMATION**

Digital as-built information shall be provided by the Engineer of Record in AutoCAD and PDF format and shall include all information required on the as-built drawings. Digital pictures of all items of interest such as utility crossings and separations should be included.

## **Part V**      **Gravity Sewer**

### **1.      Material**

Suitable couplings complying with ASTM specifications shall be used for joining dissimilar materials that consider the leakage limitations on these joints.

#### **a.    Ductile Iron Pipe**

- i.    Pipe shall be manufactured as per AWWA C141 in 18-foot lengths. Pipe shall be Class 50, as manufactured by Griffin, U.S. Pipe, American, Tyler, or Clow.**
- ii.   Pipe joints shall be of the push-on type as per AWWA C111. Pipe lining shall be cementing mortar with a seal coat of bituminous material, all in accordance with AWWA C104.**

- iii. DIP shall be designed and manufactured in accordance with AWWA C150 and C151 for a laying condition Type 2 and pressure class rating as follows:

Minimum Pressure Class for DIP Sewer Mains

Diameter	Cover	Class
8-Inch	3 to 20 Feet	350 psi
10 to 12-Inch	3 to 14 Feet	350 psi
14 to 20-Inch	3 to 10 Feet	250 psi
24 to 64-Inch	3 to 8 Feet	200 psi

Note: For cases not specified, consult with PLURIS for further guidance.

- iv. All buried DIP and fittings shall have bituminous coating on the exterior surface in accordance with AWWA C151.

b. Polyvinyl Chloride (PVC) Pipe

- i. PVC C-900 pipe shall be made of PVC plastic having a classification of 12454-B, 12454-C, or 13364-B (with minimum tensile modulus of 500,000 psi) as defined in ASTM Specification D1784.
- ii. PVC C-900 pipe shall have integral wall bell and spigot joints for the conveyance of domestic sewage and shall be supplied in minimum 12.5-foot lengths. Fittings (private sewer service fittings) shall be made of PVC plastic having a cell classification of 12454-B 12454-C or 13343-C as defined in ASTM Specification D1784.
- iii. All PVC C-900 gravity sewer pipe and PVC C-900 fittings shall be manufactured in accordance with the latest version of ASTM D3034. Fittings shall be manufactured by pipe supplier or approved as equal and have bell and/or spigot configurations compatible with that of the pipe. Fittings shall be ductile iron fittings for six (6) inch diameter and larger pipes.
- iv. All PVC pipe up to and including 15 inches in diameter shall be C-900.
- v. PVC C-900 pipe of any make, brand, or type shall not be used for installations larger than 15 inches in diameter without first receiving written approval of PLURIS.
- vi. PVC C-900 pipe shall not be used for installations deeper than twenty (20) feet.

c. Material Identification

- i. Each length of pipe shall have plainly and permanently marked thereon the following information, as well as any additional information specifically noted in the sections below:

1. Pipe class or strength designation
2. Manufacturer's name or trademark

### 3. Nominal pipe size

#### d. Bedding Materials

For PVC sewer mains, see Section L, in the Construction Requirements "Additional Requirements for "PVC C-900" and the Standard Details for bedding requirements.

#### e. Sewer Manholes

##### i. Concrete Manholes

- a. Manholes shall be precast concrete.
- b. All manholes shall have eccentric cone sections.
- c. Precast manholes shall meet ASTM C478 as to design and manufacturing requirements.
- d. The standard joint shall be sealed with a plastic cement putty meeting Federal Specification SS-S-00210, such as Ram-Nek or a butyl rubber sealant.
- e. All lift holes must be plugged with non-shrinking grout after installation.
- f. All grade adjustment rings shall be sealed with non-shrink grout.
- g. All grade adjustment rings will be of precast concrete. No block or brick risers will be accepted.
- h. All manholes shall have 6-inch, 3,000 psi or greater concrete bottoms resting on a minimum of 12 inches of #57 stone.
- i. Sewer main flow shall enter and exit radially through the manhole.
- j. Inverts shall be constructed with a width equivalent and a height equal to  $\frac{1}{2}$  that of the effluent pipe and shall be so finished that a minimum energy loss occurs in the manhole.
- k. At each inlet and outlet, compression connectors (flexible sleeves) shall be cast into the manhole section.
- l. Flexible connectors are to be manufactured of high-quality rubber or synthetic rubber, and all strap clamps or draw bolts shall be stainless steel.
- m. Boots are to meet standards of ASTM C923.
- n. Rings and clamps are to meet standards ASTM A167 and/or ASTM C923.
- o. All manholes shall have inflow protectors. Locking manhole covers may be desirable in isolated easement locations or where vandalism may be a problem. Locking manhole covers may be required in wetland areas.
- p. Precast polymer concrete manholes may be utilized.

##### ii. Manhole Frame and Cover Materials

- a. Manhole frames and covers shall be Class 35 gray iron with "Sanitary Sewer" forged into the cover as indicated in the details.
- b. Rings and cover shall be stamped with the make and model.
- c. For installation in roadways, use a Type 1 ring and cover, and place sufficient depth concrete below the pavement around the ring to ensure contact with manhole.
- d. For installation in unpaved areas, use Type 2 ring and cover.
- e. Use Type 3 ring and cover for installations necessitating watertight requirements.
- f. Locking covers shall be required in all outfall locations.

- g. Castings shall be machined to give even and continuous bearing on the full length of the frame.
- h. Castings shall be free of porosity and blow holes.
- i. Manhole frames shall be bolted to the manhole, except in paved streets.
- j. All manhole rings in roadways shall be encased in a concrete collar of 3,000 psi or greater concrete beneath the asphalt, with the cover flush with the top of pavement.
- k. Watertight manhole frames and covers shall have neoprene gasket and machined bearing surfaces.
- l. Bolts shall be standard hexagonal head, countersunk such that when fully tightened the bolt head is flush with the top of locking bolts.
- m. Only stainless steel locking bolts shall be used.
- n. Use of more than one (1) paving ring to achieve paving grade requires PLURIS approval.

iii. Manhole Steps

- a. Manhole steps shall be permitted with precast manhole sections.
- b. Steps shall be of polypropylene material reinforced with a ½ inch diameter reinforcing rod.
- c. Manhole steps shall be designed for a vertical load of 400 pounds and a horizontal pull-out load of 1,000 pounds.
- d. Steps shall be set twelve (12) inches on center.
- e. Holes for the installation of manhole steps shall not project through the manhole wall but shall stop a minimum of one (1) inch from the outside wall.
- f. Steps shall be at least twelve (12) inches clear width and shall project at least 5 inches from the wall into which they are embedded.
- g. Steps shall be located along the effluent side of the manhole.
- h. The eccentric cone shall be oriented so that the steps are vertical.

over the downstream. The minimum diameter of manholes shall be 4 feet (48 inches). Larger diameters are preferable for large diameter sewers. A minimum access diameter of 24 inches shall be provided.

- i. Manholes for sewers less than 16 inches in diameter shall be a minimum of 4 feet in diameter. Manholes for sewers 16 inches in diameter or greater shall be a minimum of 5 feet in diameter.
- j. Any manholes without rubber boots will not be accepted. Boots shall be accompanied by stainless steel banded #316 connection.
- k. Manholes shall be waterproofed by wrapping all joints with a minimum eight (8) inches width a band of inorganic fabric felt saturated in waterproofing asphalt.
- l. Waterproofing shall be installed by mopping asphalt over the joint area, then wrapping the felt around the joints, and finally mopping the felt with another coat of asphalt.

f. For Service Connections

i. Pipe Materials

- a. PVC pipe shall be C-900 or greater supplied in minimum of 18-foot individual lengths. The pipe requires gasket joints.
- b. PVC pipe shall meet the requirements of ASTM D3033 (C-900) as furnished by Johns-Manville, Gifford Hill, David, Olin, or approved equal. The pipe may be joined by

elastomeric gaskets.

- c. DIP shall be used for sanitary sewer for services with less than three (3) feet of cover or more than twenty (20) feet of cover. Pressure class and thickness class of all ductile iron lines with less than three (3) feet of cover will be indicated on all plan and profile sheets. Ductile iron services shall also be used in all cases where a water supply well is located within 100 feet of the sewer service line.
- ii. Service Materials
  - a. PVC service wyes shall be of the same material as the main and shall be factory gasket X gasket X gasket wyes, compounded for sewer service.
  - b. Ductile Iron Service Wye's shall be of the same material as the main and shall be factory gasket X gasket X gasket wyes, compounded for sewer service.
  - c. Service Wye's for PVC services shall be PVC with a PVC cap at the right-of-way.
  - d. Sewer service saddles are not prohibited.

## 2. Design

- a. Location
  - i. All public sanitary sewer mains shall be installed in dedicated street right-of-way or in dedicated utility easements. Mains located within NCDOT right-of-way shall be placed in accordance with NCDOT standards and the applicable encroachment permit.
  - ii. Minimum widths sanitary easements shall be as follows:
    - 50 feet Construction Easement
    - 30 feet Permanent Easement
  - iii. The size of easements for sanitary sewer mains greater than 24 inches shall be determined by PLURIS.
  - iv. Sewer mains shall be centered within their easements unless otherwise determined by PLURIS.
- a. Proposed sewers paralleling a creek shall be designed to a proper depth to allow lateral connections such that all creek crossings will be below stream bed elevation. The top of the sewer main shall have at least one (1) foot of cover between it and the stream bed. Concrete encasement shall be required when the cover between the top of the pipe and the stream bed is less than three (3) feet. Sewers entering or crossing streams shall be constructed of ferrous metal pipe with mechanical joints; otherwise, they shall be constructed so they will remain watertight and free from changes in alignment or grade and pressure tested to 150 psi. PVC pipe may be used where a minimum of three (3) feet of cover can be maintained. Material used to backfill the trench shall be stone, coarse aggregate, washed gravel, or other materials that will not readily erode, cause

siltation, damage pipe during placement, or corrode the pipe.

- v. Sanitary sewer mains shall not be installed under any part of water impoundments.
- vi. All private sewer collection mains inside PLURIS service area that will connect or will discharge into a PLURIS sewer system shall comply with all PLURIS design, siting, and installation criteria outlined herein. The owner of the private sewer collection system shall meet all state design requirements and obtain a state permit to construct and operate the private system.
- vii. No developer, contractor, or property owner shall place any part of a structure, permanent equipment, permanent retaining wall, fence, or impoundment within sanitary sewer easements or utility easements dedicated to PLURIS.
- viii. Fill or cut slopes are not allowed to extend into easements except by specific approval of PLURIS.
- ix. Sewer line easements shall be graded smooth; free from rocks, boulders, roots, stumps, and other debris; and seeded and mulched upon completion of construction. Easements across sloped areas shall be graded uniformly across the slope to no steeper than a 5:1 ratio.
- x. Mains shall be deep enough to serve the adjoining property and allow for sufficient slope in lateral lines and shall have the following minimum covers. These requirements may be waived at the discretion of PLURIS, in which case DIP shall be installed.
  - a. Four (4) feet from the top of the pipe to finished subgrade in roadways
  - b. Three (3) feet from the top of pipe to finished grade outside roadways
- xi. Mains over twenty (20) feet deep require ductile iron for the entire run between manholes and shall be approved by PLURIS.
- xii. Mains shall have a minimum vertical separation of twenty-four (24) inches between storm pipe when the horizontal separation is three (3) feet or less unless structural bridging is provided.
- xiii. There shall be a minimum of five (5) feet horizontal separation between parallel gravity and/or force mains.
- xiv. Sewer mains shall have a minimum horizontal separation distance of ten (10) feet from water lines unless the top of the sewer main is at least eighteen (18) inches below the bottom of the water main, and there is a horizontal separation of at least three (3) feet from the closest edge of pipes.
- xv. Where sewer mains cross beneath water mains with a vertical separation of eighteen (18) inches or less, or where water mains cross under sewer mains, the entire leg of sewer main shall be DIP, and the void space between the pipe crossing shall be backfilled with suitable

fill that meets or exceeds NCDOT specifications. The water main shall be centered at the point of crossing, which shall be at an approximate 90-degree angle.

- xvi. Structures - The sewer outfalls, headwalls, manholes, gate valve boxes, or other structures shall be located so they do not interfere with the free discharge of flood flows of the stream.
  - xvii. Alignment - Sewers crossing streams shall be designed to cross the stream as nearly perpendicular to the stream flow as possible and shall be free from change in grade. Sewer systems shall be designed to minimize the number of stream crossings.
  - xviii. Aerial crossings shall be prohibited unless specifically allowed by PLURIS and only under extreme circumstances.
    - a. Proper joint technology (e.g., flanged or restrained), adequate supports to prevent excessive flexion, or a combination of both shall be provided for all aerial pipe crossings. Supports shall be designed to prevent frost heave, overturning, and settlement.
    - b. Precautions against freezing, such as insulation and increased slope, shall be provided. Expansion jointing shall be provided between above ground and below ground sewers. Where buried sewers change to aerial sewers, special construction techniques shall be used to minimize heaving.
    - c. For aerial stream crossings, the impact of flood waters and debris shall be considered. The bottom of the pipe should be placed no lower than the elevation of the 25-year flood. DIP with mechanical joints shall be required.
    - d. In the event that the 25-year flood elevation cannot be determined, or the proposed gravity sewer must be placed below the 25-year flood elevation, a letter shall be provided by the applicant upon certification stating, "Regular and proper inspection and maintenance of the aerial crossing shall be provided to ensure that the creek/stream flow is not impeded and that no damage will be caused to upstream or adjacent properties."
  - xix. Anti-Seepage Collars - In areas where the sewer trench has the potential to drain wetlands, anti-seepage collars shall be installed. Please be informed, in these areas, a 401/404 permit may be required. All areas directional bored under wetlands require anti-seep collars.
- b. Protection of Potable Water Supplies and Storm Sewers
    - i. Cross Connections Prohibited - There shall be no physical connections between a public or private potable water supply system and a sewer, or appurtenance thereto which would allow the passage of any wastewater or polluted water into the potable supply. No water pipe shall pass through or meet any part of a sewer manhole.
  - c. Size
    - i. The minimum diameter size for gravity sewer mains conveying wastewater shall be eight (8)

inches for public sewers and six (6) for private sewers.

- ii. New sewer systems shall be designed based on NC Regulation Design Criteria and NCDEQ requirements for flow as found in 15A NCAC 02T .0114.
- iii. The ratio of peak to average daily flow shall be as follows:

$Q_{max} / Q_{avg.}$	$Q_{avg.}$ average flow (GPD)
4.0	3,000 or less
3.5	3,000 – 6,000
3.0	6,000 – 10,000
2.5	Greater than 10,000

- iv. Sewers shall be designed to flow half full at the average daily flow.
- v. Sanitary sewers shall be designed to carry the projected peak flow at no more than 3/4 full.
- vi. All sewers shall be designed and constructed to give mean velocities, when flowing full, of not less than 2.0 feet per second, based on Manning's formula using an "n" value of 0.013. The following are the minimum slopes to provide; however, slopes greater than these are recommended.

The minimum grades for public sanitary sewers shall be as follows:

<u>Main Size (in.)</u>	<u>Minimum Slope (ft/100 ft)</u>
6	0.60
8	0.40
10	0.28
12	0.22
<u>Main Size (in.)</u>	<u>Minimum Slope (ft/100)</u>
14	0.17
15	0.15
16	0.14
18	0.12
21	0.10
24	0.08
27	0.07
30	0.06

- vii. The minimum slope for the uppermost reach of a sanitary sewer line shall be 1.00% regardless of sewer line size.

- viii. The maximum grade for sanitary sewers is 10%. The maximum velocity in sanitary sewers is 15 ft./sec.

- ix. Sewer extensions should be designed for projected flows even when the diameter of the receiving sewer is less than the diameter of the proposed extension at a manhole, with special consideration of an appropriate flow channel to minimize turbulence when there is a change in sewer size.
- x. A downstream analysis of the receiving sewer is required prior to submitting applicable permits associated with the proposed project.
- xi. Pipe diameter changes shall occur in a manhole with the invert of the larger pipe lowered sufficiently to maintain the same energy gradient. An approximate method of securing these results is to place the 0.8 depth point of both sewers at the same elevation.
- xii. Manning's Equation for Gravity Flow  $V = [1.486/n] \times R^{.66} \times S^{.5}$

Where:

V = Velocity in feet per second

n = Coefficient of Roughness (0.013) S = Slope in foot per foot

R = Hydraulic Radius in feet (cross sectional area divided by the wetted perimeter)

- xiii. The pipe diameter and slope shall be selected to obtain the greatest practical velocities to minimize settling problems. Designs must include a minimum scouring velocity of 2 feet per second. Sewers shall not be oversized to justify using flatter slopes. If the minimum scouring velocity cannot be maintained during initial operation prior to the design flow capacities being reached, the ability to periodically flush the system shall be required.

#### d. Manholes

- i. Manholes shall be spaced at a maximum distance of 425 feet apart for all sewer lines.
- ii. Manholes for sewers less than sixteen (16) inches in diameter shall be a minimum of four (4) feet in diameter. Manholes for sewers sixteen (16) inches in diameter or greater shall be five (5) feet in diameter. A minimum access diameter of twenty-four (24) inches shall be provided.
- iii. Manholes shall be installed at each change of direction of line and/or grade. The flow channel through manholes should be made to conform in shape and slope to that of the entering sewer line. Therefore, no elevation drop shall occur at the manhole and centerline inverts shall be used.
- iv. Inside drop manholes shall be used when necessary. Moor base or outside drop manholes shall not be permitted.

- v. Where the difference in elevation between the incoming sewer and the manhole invert is less than two (2) feet, the pipe must extend over the invert so that material is deposited directly into the stream of flow. Where the incoming sewer is elevated greater than two (2) feet, the influent line must have a fixed drop to convey the flow to the invert.
- vi. A bench shall be provided on each side of any manhole channel when the pipe diameter(s) are less than the manhole diameter. The bench shall be sloped no less than 1/2 inch per foot (4%). The invert elevation of any lateral sewer, service connection, or drop manhole pipe shall be above the bench surface elevation. No invert shall be located directly on the surface of the bench.
- vii. Inlet and outlet pipes shall be joined to the manhole with a gasketed flexible watertight connection or any watertight connection arrangement that allows minor differential settlement of the pipe and manhole wall to take place.
- viii. Flow Channel
  - a. The flow channel straight through a manhole shall be made to conform as closely as possible in shape and slope to that of the connecting sewers. The channel walls shall be formed or shaped to three quarters (3/4) of the height of the crown of the outlet sewer in such a manner that it does not obstruct maintenance, inspection, or flow in the sewers.
  - b. When curved flow channels are specified in manholes, including branch inlets, minimum slopes should be increased to maintain acceptable velocities.
- ix. Sewers shall be laid with uniform slope between manholes.
- x. All sewers shall have straight alignment between manholes. Straight alignment shall be checked by using either a laser or lamping.
- xi. Location
  - a. Manholes shall be installed at the end of each line, at all changes in grade, size, or alignment, at all intersections, and at distances not greater than 425 feet for all sewers.
  - b. Cleanouts may not be used in lieu of manholes for 6-inch private sewer lines.
- xii. Watertightness

Manholes shall be designed for protection from the 100-year flood using any of these options that follow:

- i. Manhole rims shall be two (2) feet above the 100-year flood elevation.
- ii. Manholes shall be watertight and vented two (2) feet above the 100-year flood elevation.
- iii. Manholes shall be vented every 1,000 feet or every other manhole, whichever is greater.
- iv. In some situations, recast polymer concrete manholes may be utilized.

- xiii. Buoyancy - Buoyancy shall be considered, and flotation of the manholes shall be prevented with appropriate construction in every design where high groundwater conditions are anticipated. All manholes shall have a minimum six (6) inches extended base.
- xiv. Inspection and Testing - The specifications shall include a requirement for inspection and testing for watertightness or damage prior to placing into service.
- xv. Corrosion Protection for Manholes
  - a. Where corrosive conditions exist due to septicity or other causes are anticipated, consideration shall be given to providing corrosion protection on the interior of the manholes by applying an epoxy coating.
  - b. Where high flow velocities are anticipated, the manholes shall be protected against displacement by erosion and impact.
- e. Pipes
  - i. The pipe material selected shall be adapted to local conditions, such as character of industrial wastes, possibility of septicity, soil characteristics, exceptionally heavy external loadings, abrasion, corrosion, and similar problems. Consideration shall also be given to pipes and compression joint materials subjected to corrosive or solvent wastes.
  - ii. The specifications shall stipulate: (a) the pipe interior, (b) sealing surfaces, (c) fittings and other accessories shall be kept clean; (d) pipe bundles be stored on flat surfaces with uniform support; (e) stored pipe shall be protected from prolonged exposure (6 months or more) to sunlight with a suitable covering (canvas or other opaque material); (f) air circulation shall be provided under any covering; (g) gaskets shall not be exposed to oil, grease, ozone (produced by electric motors), excessive heat and direct sunlight; and (h) consultation with the manufacturers for specific storage and handling recommendations.
  - iii. All sewers shall be designed to prevent damage from superimposed live, dead, and frost induced loads. Proper allowance for loads on the sewer shall be made because of soil and potential groundwater conditions, as well as the width and depth of trench. Where necessary, special bedding, haunching and initial backfill, concrete cradle, or other special construction shall be used to withstand anticipated potential superimposed loading or loss of trench wall stability. See ASTM D 2321 OR ASTM C 12 when appropriate.
  - iv. For new pipe materials for which ASTM standards have not been established, the Engineer of Record shall provide complete pipe specifications and installation specifications developed based on criteria adequately documented and certified in writing by the pipe manufacturer to be satisfactory for the specific detailed plans.
  - v. The use of header and/or manifold piping will not be permitted in any application.

f. Joints

- i. The installation of joints and the materials used shall be included in the specifications. Sewer joints shall be designed to minimize infiltration and to inhibit the entrance of roots throughout the life of the system.

- ii. Relation to Water Supply Sources

- a. 100 feet distance shall be maintained between any private or public water supply source, including any WS-I waters or Class I or Class II impounded reservoirs used as a source of drinking water. If this minimum separation cannot be maintained, ferrous metal pipe with joints equivalent to public water supply design standards and pressure tested to 150 psi to assure watertightness shall be used. The minimum separation shall, however, not be less than twenty-five (25) feet from a private well or fifty (50) feet from a public water supply well.
- b. All existing waterworks units, such as basins, wells, or other treatment units, within 200 feet of the proposed sewer shall be shown on the engineering plans.

- iii. Relation to Water Mains and Storm Sewers

- a. Horizontal and Vertical Separation

- i. Sewers shall be laid at least ten (10) feet horizontally from any existing or proposed water main. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10-foot separation, the appropriate reviewing agency (e.g., NCDEQ) may allow deviation on a case-by-case basis, if supported by data from the Engineer of Record. Such deviation may allow installation of the sewer closer to a water main, provided that the water main is in a separate trench or on an undisturbed earth shelf located on one side of the sewer and at an elevation, so the bottom of the water main is at least eighteen (18) inches above the top of the sewer.
- ii. If it is impossible to obtain proper horizontal and vertical separation as described in this section or anytime the sewer is over the water main, both the water main and sewer must be constructed of ferrous metal pipe complying with public water supply design standards and be pressure tested to 150 psi to ensure watertightness before backfilling.
- iii. A 24-inch vertical separation shall be provided between storm sewer and sanitary sewer lines, or ferrous metal pipe specified.

- b. Crossings

- i. Sewers crossing water mains shall be laid to provide a minimum vertical distance of eighteen (18) inches between the outside of the water main and the outside of the

sewer. The crossing shall be arranged so that the sewer joints will be of equal distance and as far as possible from the water main joints.

- ii. When it is impossible to obtain proper horizontal and vertical separation as stipulated in this section, one of the following methods must be specified:
  - 1. The sewer shall be designed and constructed of ferrous metal pipe and shall be pressure tested at 150 psi to ensure water tightness prior to backfilling, or
  - 2. Either the water main or the sewer line may be encased in a watertight carrier pipe that extends ten (10) feet on both sides of the crossing, measured perpendicular to the water main. The carrier pipe shall be of materials approved by the regulatory agency for use in water main construction.
- g. Buoyancy - Buoyancy of sewers shall be considered, and flotation of the pipe shall be prevented with appropriate construction where high groundwater conditions are anticipated.
- h. Depth - Three (3) feet minimum cover shall be provided for all sewers unless ferrous metal pipe is specified. Ferrous metal pipe, or other pipe with proper bedding to develop design supporting strength, shall be provided where sewers are subject to traffic bearing loads. Additional protection shall be provided for sewers that cannot be placed at a depth sufficient to prevent damage.
- i. Design Capacity and Design Flow - Sewer capabilities shall be designed for the estimated ultimate tributary population including consideration not limited to the maximum anticipated capacity of institutions and industrial parks. The capability of downstream sewers to accept future flow made tributary to the collection system shall be evaluated by the engineer representing the Applicant. Where future relief sewers are planned, analysis of alternatives should accompany initial permit applications.
- j. Standards - Installation specifications shall contain appropriate requirements based on the criteria, standards, and requirements established by the construction industry in its technical publications. Requirements shall be set forth in the construction specifications for the pipe and methods of bedding and backfilling thereof so as not to damage the pipe or its joints, impede cleaning operations and future tapping, create excessive side fill pressures and ovality of the pipe, or seriously impair flow capacity.
- k. Service Connections

#### General Requirements

All residential subdivision lots shall be served by gravity unless otherwise approved by PLURIS. If a pump is approved, it shall be privately maintained, must pump into a service connection placed on the lot, and must have a note on the recorded Plat indicating that a private pump is required to serve the lot.

- a. Service connections to the main lines shall be perpendicular to the main line and shall extend to the edge of the right of way or easement line.
- b. Cleanouts are required on all services with a maximum spacing of 75 feet on 4-inch services and 100 feet on 6-inch services, and at the right of way line or

edge of easement. All cleanouts shall extend a minimum of six (6) inches above finished grade with screw-in cap and concrete donut or cleanout method requirements in accordance with other PLURIS Standard Details.

d. Sewer cleanouts located in paved areas that bear vehicle loading must have ductile iron risers, ductile iron fittings, and brass caps, or meet optional cleanout method requirements in accordance with Standard Details.

### 3. Construction

#### a. Siltation and Erosion

Construction methods that will minimize siltation and erosion shall be employed. The Engineer of Record shall include in the project specifications the method(s) to be employed in the construction of sewers. Such methods shall provide adequate control of siltation and erosion by limiting unnecessary excavation, disturbing or uprooting trees and vegetation, dumping soil or debris, or pumping silt-laden water into streams. Specifications shall require that cleanup, grading, seeding, and planting or restoration of all work areas shall begin immediately. Exposed areas shall not remain unprotected for more than seven (7) days unless a sedimentation and erosion control plan is submitted to and approved by the NCDEQ Division of Land Resources.

#### b. Bedding, Haunching, and Initial Backfill

- i. Bedding Classes, A, B, C, or crushed stone as described in ASTM C 12 shall be used and carefully compacted for all rigid pipe, provided the proper strength pipe is used with the specified bedding to support the anticipated load, based on the soil type encountered and potential ground water conditions.
  - ii. Embedment materials, Classes I, II, or III, as described in ASTM D 2321, for bedding, haunching and initial backfill, shall be used and carefully compacted for all flexible pipe provided the proper strength pipe is used with the specified bedding to support the anticipated load based on the type of soil encountered and potential groundwater conditions. (See Class definitions in section L.2.f.)
  - iii. All water entering the excavations or other parts of the work shall be removed until all the work has been completed. No sanitary sewer shall be used for the disposal of trench water.
- c. Sanitary sewer mains shall be deep enough to serve the adjoining property and allow for sufficient slope in lateral lines. All sanitary sewer mains shall have the following minimum covers:
1. Four (4) feet from the top of pipe to finished subgrade when under a roadway or parking lot.
  2. Three (3) feet from the top of pipe to finished grade when outside a roadway.

The above requirements may be waived at the direction of PLURIS, in which case DIP of appropriate thickness and pressure class shall be installed.

- d. Sewer mains from fourteen (14) to twenty (20) feet deep shall require special bedding in accordance with the Standard Details.

- e. Sewers over twenty (20) feet deep shall require ductile iron or reinforced concrete pipe for the entire run between manholes.
- f. Pipe trench excavation and backfilling shall be performed in accordance with Part II of these specifications.
  - i. The width of the trench shall be ample enough to allow the pipe to be laid and jointed properly and to allow the bedding and haunching to be placed and compacted to adequately support the pipe. The trench sides shall be kept as nearly vertical as possible. When wider trenches are specified, appropriate bedding class and pipe strength shall be used.
  - ii. In unsupported, unstable soil, the size and stiffness of the pipe, stiffness of the embedment, and in-situ soil and depth of cover shall be considered in determining the minimum trench width necessary to adequately support the pipe.
  - iii. Ledge rock, boulders, and large stones shall be removed to provide a minimum clearance of six (6) inches below and on each side of all pipes.
- g. Where sanitary sewers cross beneath water mains with a vertical separation of eighteen (18) inches or less or where water mains cross under sewer mains, both lines shall be DIP for ten (10) feet on either side of the point of crossing. The waterline pipe shall be centered at the point of crossing.
- h. Sanitary sewers shall have the top of pipe at least two (2) feet below the bottom of storm sewer pipe when the horizontal separation between the closest edges of the two pipes is three (3) feet or less. Where sanitary and storm sewers cross with a vertical separation of less than two (2) feet, the sanitary sewer shall be of water main standard DIP for ten (10) feet on either side of the point of crossing with the sanitary sewer pipe section centered at the crossing.
- i. There shall be a 5-foot horizontal separation between parallel gravity and/or force mains.
- j. Additional Requirements for (PVC)
  - i. For PVC C-900 pipe, the pipe shall be produced with bell and spigot end construction. Joining will be accomplished by rubber gasket in accordance with manufacturer's recommendation, unless otherwise directed or approved by PLURIS. Each pipe length shall be clearly marked with information including pipe size, profile number, and class number.
  - ii. The installation shall satisfy the requirements of the manufacturer and/or the following, whichever is more stringent:
    - a. Installation of PVC C-900 pipe shall follow the recommendations of ASTM D-2321 "Underground Installation of PVC C-900 Sewer Pipe".

Pipe bedding and embedment material shall be either Class I or Class II. For PVC C- 900 pipe, Class III materials may also be used. In any area where the pipe will be installed below existing or future ground water levels or where the trench could be subject to inundation, only Class I material shall be used for bedding and

embedment.

- b. The manufacturer's specifications or otherwise approved method shall be used in determining the stiffness class of the pipe to be installed to attain the required deflection control. The class of the pipe must be approved by PLURIS prior to installation.
- c. The bedding (4 inches minimum) and embedment materials shall be per ASTM D2321. The embedment materials shall be installed from trench wall to trench wall and from the invert to a minimum of six (6) inches above the crown of the pipe.
- d. The bedding and embedment material shall be compacted to a minimum of 90% Standard Proctor density for Class I and II materials and a minimum of 95 % Standard Proctor density for Class III materials.
- e. If hydraulic jack shoring is utilized for trench walls, where shoring is used, it shall be kept to the area just above the top of the pipe. This will ensure the embedment materials and pipe will not be disturbed when removal is made.
- f. Bedding and embedment material classifications shall be defined as follows:

CLASS I - Angular, (1/4 to 1 ½ inch) graded stone, including several fill materials that have regional significance such as coral, slag, cinders, crushed stone, crushed gravel, and crushed shells.

CLASS II - Coarse sands and gravels with maximum particle size of 1 ½ inch, including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil types of GW, GP, SW and SP are included in this class.

CLASS III - Fine sand and clayey gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures. Soil types of GM, GC, SM, and SC are included in this class.

CLASS IV - Silt, silty clays, and clays, including inorganic clays and silts of medium to high plasticity and liquid limits. Soil types of MH, ML, CH, and CL are included in this class. These materials are not recommended for embedment.

- iii. Pipe shall be laid going uphill.

For Service Connections

#### I. General Requirements

- a. See design criteria contained herein for additional installation requirements.
- b. Sewer laterals shall not be in easements when gravity service can be provided to the property frontage at the street.
- c. Direct sewer service taps shall not be allowed on sewer interceptor or outfall mains 18 inches in diameter or larger, except by manhole connection..

- d. All services entering a manhole shall be placed a minimum of six (6) inches below any manhole seam and must be sealed watertight on the inside and outside of the manhole. The service must extend to the receiving invert for deposition of solids to prevent accumulation of solids on the invert bench.
- e. Each separately owned structure requires a separate tap to the sewer main.
- f. All service connections to existing sanitary sewer mains shall be made by PLURIS. Service connections to new mains may be made by the Contractor but must include the use of wye (not tee) connections. Taps onto new lines may be approved only by PLURIS. All service lines with less than three (3) feet of cover or deeper than twenty (20) feet shall be made of DIP.
- g. Service lines between three (3) and eight (8) feet in depth do not require special bedding. PVC service lines between eight (8) and twenty (20) feet in depth shall require Class I bedding from four (4) inches below the service line to four (4) inches above the service line.
- h. Final Backfill
  - i. Final backfill shall be of a suitable material removed from excavation except where other material is specified. Debris, frozen material, large clods or stones, organic matter, or other unstable materials shall not be used for final backfill within 2 feet of the top of the pipe. Stones used in backfills shall not be greater than 1 inch along any axis.
  - ii. Final backfill shall be placed in such a manner as not to disturb the alignment of the pipe.
- II. Individually owned structures shall require at least one (1) sewer tap.
- III. Service taps into mains shall be made with factory service gasket X gasket X gasket wyes and made of the same material as the main.
- IV. Service connections to the main lines shall be perpendicular to the main line and shall extend to the edge of the right-of-way or easement line. Four-inch lines shall have a minimum slope of 0.60 ft./100 feet. Cleanouts shall be required on all sewer services with a maximum spacing of 50 feet on 4-inch services and 100 feet on 6-inch services. A cleanout shall be placed on all service lines at the right-of-way line or at the edge of the easement. All cleanouts shall be protected with a concrete donut and extend a minimum of six (6) inches above finished grade as in accordance with the Standard Details.

#### 4. Testing

**The Contractor/Applicant shall furnish all materials, labor, and equipment to perform all testing.**

- a. The maximum allowable deflection after installation shall BE LESS THAN 5% of the pipe diameter. PLURIS may require a mandrel to be pulled through a segment or segments of lines if CCTV footage suggests needs to further be verified. For PVC C-900 Pipe the following shall apply:

Nominal Diameter (inches)	(Proving Ring) Diameter Mandrel (inches)
6"	5.65"
8"	7.76"
10"	9.08"
12"	10.79"
15"	14.09"
18"	16.53"
21"	19.30"
24"	22.08"
27"	24.84"
30"	27.62"
33"	30.38"
36"	33.15"
42"	38.68"
48"	44.21"
54"	49.74"
60"	55.27"

b. Deflection Test

- i. Deflection tests shall be performed on all pipe installations. The tests shall be conducted after the final backfill has been in place at least thirty (30) days to permit stabilization of the soil-pipe system. As an alternative to waiting thirty (30) days to permit stabilization of the soil-pipe system, PLURIS will accept certification from a soil testing firm verifying that the backfill of the trench has been compacted to at least 95% maximum density.
- ii. No pipe shall exceed a deflection of 5%. If deflection exceeds 5%, replacement or correction shall be accomplished in accordance with requirements in the approved specifications.
- iii. The rigid ball or mandrel used for the deflection test shall have a diameter not less than 95% 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 D2122 Standard Test Method of Determining

Dimensions of Thermoplastic Pipe and Fittings. The test shall be performed without mechanical pulling devices.

c. Visual Testing and Observation

- i. All materials used must be approved by PLURIS prior to installation. Rejected materials shall be immediately removed from the job.
- ii. Gravity sanitary sewer lines shall be clean and free from obstructions and shall be visually inspected from every manhole. Lines that do not exhibit a true line and grade or that have structural defects shall be corrected. Sanitary sewer service connections shall be visually inspected prior to backfilling.

d. Video Assessment and Cleaning

- i. As a final measure required for acceptance, the Contractor shall clean and televise all newly installed sewer mains prior to acceptance by PLURIS. The Contractor shall televise the sewer main, and all lateral connections installed from the upstream to downstream manhole with no reverse setups or cutaways. Throughout shooting, the camera shall be panned and tilted for a complete view of the main. Lighting shall be adequate to view the entire sewer main and service connections from beginning to end. The video inspection shall be submitted to PLURIS on DVD and formatted with software compatible and readable by PLURIS. PLURIS shall not be responsible for purchasing additional software necessary to view the videos.
- ii. The camera shall be advanced at a uniform rate that allows a full and thorough inspection of the new sewer main. The camera shall be a color, pan, and tilt camera. The picture quality and resolution shall be acceptable and sufficient to allow a complete inspection with no lapses in coverage. The length of the sewer main shall be measured and recorded on the video screen. The distance counter shall be calibrated before shooting the inspection video.
- iii. The Contractor shall clean the sewer mains ahead of video inspection with a high-velocity water jet. The video inspection shall take place within two (2) hours of cleaning operations as witnessed by PLURIS. All construction debris shall be collected and removed in the downstream manhole and shall not be released into the sewer system.
- iv. A PLURIS representative shall be present throughout the cleaning and televising of the sewer mains to verify that the video work complies with the specifications.
- v. Video inspection of services shall show a 5-gallon water-drop and the lot number clearly written on the service stack.
- vi. A CCTV contractor must supply video footage of each individual property from the service to the sewer main. Each service on each property shall be clearly numbered to correlate within the development.
- vii. Prior to submitting the DVD to PLURIS, the Contractor shall label the DVD with the following information:

- Name of the Project/Development.

- Name and contact information of responsible party.
- Date of televising.
- Manhole identification as shown on the design plans.

e. Manholes

i. Vacuum Testing

a. All newly installed manholes shall pass a vacuum test in accordance with ASTM C 1244-93. The Contractor shall supply all equipment and materials necessary to vacuum test the manholes.

b. Vacuum Testing shall not be initiated until the manholes and all specified coatings and lining materials have been cured in accordance with manufacturer recommendations.

c. A PLURIS representative shall be present and witness all vacuum testing.

d. The following vacuum testing criteria shall apply for compliance with the testing procedure.

i. A vacuum of ten (10) inches of mercury shall be drawn with an approved vacuum testing unit.

ii. The testing time shall not be measured until after the vacuum and pump have been shut off.

iii. The time required for the vacuum to drop from ten (10) inches to nine (9) inches of mercury shall meet or exceed the values listed in the following table:

Manhole Vacuum Testing Time

Depth (feet)	Manhole Diameter (inches)		
	<u>48</u>	<u>60</u>	<u>72</u>
	Time (seconds)		
8	20	26	33
10	25	33	41
12	30	39	49
14	35	48	57
16	40	52	67
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97
26	64	85	105
28	69	91	113
30	74	98	121

Note: If depth falls below 8 feet or between two depths, the next deepest increment of depth shall be used.

## 5. Repairs

### a. Sewer Main Repairs

- i. PVC C-900 Pipe – replace damaged section with PVC C-900 pipe and install a mechanical coupling.
- ii. DIP – replace damaged section with DIP pipe and install a mechanical coupling.
- iii. HDPE Pipe – replace damaged section with new HDPE pipeline section and install electrofusion couplings at both ends; minor breaches may be repaired with an electrofusion repair coupling as considered by a manufacturer's representative.
- iv. No FERNCO style couplings will be permitted.
- v. Encasement of fittings and bolts in concrete will not be permitted.

### b. Installation

- i. All repairs to damaged sanitary sewer lines in paved areas shall be backfilled with ABC stone (crushed stone) to a density of 95% Standard Proctor.
- ii. All repairs to damaged sanitary sewer lines shall be bedded with six (6) inches of washed stone and compacted to a minimum of 95% Standard Proctor density before installing the new joint of ductile iron.

## Part VI Sewer Force Main

### 1. Material

#### a. General

- i. Force mains smaller than four (4) inches in diameter shall be PVC or HDPE, while force mains four (4) inches or larger shall be DIP, PVC, or HDPE.
- ii. Force mains shall be of a size greater than the diameter of solid capable of being passed by the sewage pumps.

PVC and HDPE pipe requires the installation of 3-inch-wide detector tape a maximum of two (2) feet below the finished grade and green plastic coated #10 copper tracer wire affixed directly on top of the sewer main and made accessible at all valve boxes.

- iii. All fittings shall be as manufactured by Rusco, Clow, Tyler, American, Union, or Griffin.
- iv. All taps into an existing Force Main shall utilize a Tapping Sleeve of an appropriate size.
- v. Force main shall be installed with a minimum cover of three (3) feet measured from the top

of the pipe to the finished subgrade.

b. Ductile Iron Pipe

- i. DIP shall be manufactured as per AWWA C141 in minimum 18-foot lengths. Pipe shall be Class 51, as manufactured by Griffin, U. S. Pipe, American, or Clow.
- ii. DIP shall be designed and manufactured in accordance with AWWA C150 and C151 for a laying condition Type 2. Pipe joints shall be of the push-on type per AWWA C111. Pipe lining shall be cementing mortar with a seal coat of bituminous material, all in accordance with AWWA C104. DIP joints shall be mechanical or gasketed joint as per AWWA C151.

Working pressure shall be as follows:

<u>Diameter</u>	<u>Pressure</u>
4" – 12"	350 psi
14" – 20"	250 psi
24"	200 psi
30" – 54"	150 psi

- iii. DIP shall conform to ANSI/AWWA C151/A21.51 "Ductile Iron Pipe, Centrifugally Cast in Metal Molds for Water or Other Liquids."
- iv. The thickness and pressure class of DIP required for the installation and operating conditions during the expected service life of the force main shall be determined in accordance with ANSI/AWWA C150/A21.50 "Thickness Design of Ductile Iron Pipe."
- v. Fittings for DIP shall conform to ANSI/AWWA C110/A21.10 "Ductile-Iron and Gray-Iron Fittings, 3 In. through 48 In. for Water and Other Liquids" or ANSI/AWWA C153/A21.53 "Ductile Iron Compact Fittings, 3 In. through 24 In. and 54 In. through 66 In., for Water Service."
- vi. Force mains of DIP shall have mechanical or gasketed push-on type joints. If exposed, force mains of DIP shall have flanged joints. Restrained joint DIP may be used for anchoring purposes as described in Section 4.03C.
  - a. Gaskets shall be manufactured of vulcanized natural or synthetic rubber in accordance with ANSI/AWWA C111/A21.11 "Rubber Gasket Joints for Ductile Iron and Gray-Iron Pressure Pipe and Fittings."
  - b. Flanged DIP shall conform to ANSI/AWWA C115/A21.15 "Flanged Ductile Iron Pipe with Ductile Iron or Gray Iron Threaded Flanges."

- vii. Consideration shall be given to the existence of or the potential for development of corrosive environments within and outside the force main, and mitigation measures shall be taken to ensure corrosivity has been addressed. Sources of corrosion may include acidic soils, septic wastewater, and air entrainment within the force main. Where corrosion is deemed to be a serious problem, DIP shall be provided with cathodic protection or an internal/external encasement, lining, or coating appropriate for the pipe material and situation. Such encasements, linings, and coatings shall be manufactured or applied in accordance with the appropriate ANSI and AWWA standards.
- c. PVC Pipe
- i. PVC pipe shall meet the requirements of AWWA C-900.
  - ii. Pipe shall be pressure rated to 250 psi, AWWA C-900, integral bell with strength equal to the pipe wall, cast iron O.C., 18-foot lengths, with a solid elastomeric ring as furnished by Johns-Manville, Clow, North Star, or Robin-Tech.
  - iii. PVC pipe will require the installation of a detector tape placed a maximum of two (2) feet below the finished grade. The tracer wire shall be green plastic coated #10 copper wire affixed to the top of the force main and made accessible at all valve boxes.
  - iv. All fittings shall be as manufactured by Rusco, Clow, Tyler, American, Union, or Griffin, or approved by PLURIS.
  - v. PVC pipe may be cored when necessary, using an appropriately sized tapping sleeve.
  - vi. PVC Pipe shall be AWWA C-900 PVC pipe with push joints. Pipe and joints shall meet all applicable requirements of ASTM D-2241 and D-1785. PVC pipe requires the installation of detector tape a maximum of two (2) feet below the finished grade and a green plastic coated #10 copper wire affixed to the top of the force main and made accessible at all valve boxes.
  - vii. PVC material used in the manufacture of PVC pipe shall conform to ASTM D1784 "Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds."
  - viii. The thickness and pressure class of PVC pipe required for the installation and operating conditions during the expected service life of the force main shall be determined in accordance with AWWA C-900 "Poly (Vinyl Chloride) (PVC) Pressure Pipe, 4 In. through 12 In., for Water" or AWWA C-905 "Poly (Vinyl Chloride) (PVC) Water Transmission Pipe, Nominal Diameters 14 In. through 36 In."
  - ix. Force mains of PVC pipe shall have gasketed push-on type joints. Gaskets shall be manufactured of elastomeric material in accordance with ASTM F477 "Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe."
  - x. Mechanical joint DIP fittings conforming to ANSI/AWWA C110/A21.10 or gasketed PVC

fittings shall be used for force mains four (4) inches in diameter and larger. Solvent-welded or gasketed fittings may be used for smaller diameter force mains.

d. High-Density Polyethylene Pipe (HDPE)

- i. HDPE pipe shall be produced from a high molecular weight, high density, polyethylene resin, meeting the requirements of ASTM D3350 "Standard Specification for Polyethylene (PE) Plastic Pipe and Fitting Materials." Resin material shall be listed by PPI in the name of the manufacturer and shall be based on testing in accordance with ASTM D2837 "Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe."
- ii. HDPE pipe shall conform to ASTM D3035 "Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter" or ASTM F714 "D3035 "Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter."
- iii. The thickness and pressure class of HDPE pipe required for the installation and operating conditions during the expected service life of the force main shall be determined in accordance with AWWA C906 "Polyethylene (PE) Pressure Pipe and Fittings, 4 In. through 63 In., for Water Distribution."

Fittings for HDPE pipe shall conform to ASTM D3261 "Standard Specification for Butt Fusion of Polyethylene (PE) Plastic Fittings for PE Plastic Pipe and Tubing" and shall be manufactured by injection molding, a combination of extrusion and machining, or fabrication from HDPE pipe material.

- iv. Force mains of HDPE pipe shall be joined by the thermal butt fusion process and shall be performed in accordance with ASTM A2657 "Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings" and the manufacturer's recommendations during installation.

e. Pipe Fitting Materials

- i. Pipe fittings shall be cast, or ductile iron designed and manufactured per AWWA C110. Fittings up to and including twelve (12) inches shall be designed for an internal pressure of 250 psi. Fittings larger than twelve (12) inches shall be designed for an internal pressure of 150 psi. Joints for fittings shall be mechanical joints and shall be cement mortar lined with a seal coat of bituminous material, in accordance with AWWA C104.
- ii. All buried DIP and fittings shall have bituminous coating on the exterior surface in accordance with AWWA C151.
- iii. Except for HDPE, pipe shall be supplied in minimum of 18-foot lengths unless approved otherwise by PLURIS.

f. Material Identification

- i. Force mains shall be appropriately identified upon installation so they will not be confused with potable water lines. Green detector tape clearly labeled sanitary sewer shall be laid a maximum of two (2) feet below finished grade and green plastic coated #10 copper tracer wire shall be affixed to the top of the force main and be made accessible at all valve boxes.

- ii. Force main valves shall have valve box covers marked "Sewer."

- g. Manhole Materials - All manholes installed along a force main, and the discharge manhole shall be installed according to Section 7.2.1(F) of PLURIS Standard Specifications and coated with an approved epoxy coating.

## 2. Design

### a. General

- i. Sizes of fittings up to and including sixteen (16) inches shall be designed for an internal pressure of 250 psi.
- ii. Reaction blocking for all fittings or components subject to hydrostatic thrust shall be securely anchored using concrete thrust blocks poured in place. The reaction areas are shown in Standard Detail 6.11. No concrete shall interfere with the removal of fittings. Materials for reaction blocking shall be 3,000 psi or greater concrete.
- iii. Air release valves shall be designed at the high points of all force mains and in the valve vault of all lift stations. The air release valves shall be constructed from stainless steel and utilize a ball valve.
- iv. Force sewer mains shall be installed in dedicated public right-of-way or in dedicated utility easements having the following dimensions:

50 feet	Construction Easement
20 feet	Permanent Easement

### b. Material

- i. Pipe material and specifications shall be selected based on the installation and operating conditions of the force main following installation. Such factors shall include but not be limited to:
  - a. Installation depth and overburden pressure.
  - b. Soil conditions and groundwater presence
  - c. Corrosion resistance from both external and internal sources.
  - d. Strength required to withstand internal pressures expected during normal operation as well as those resulting from hydraulic surges and water hammer.
- ii. Force mains shall be constructed of one of the following types of pipes:
  - a. DIP
  - b. PVC C-900

c. HDPE

All pipe used for force main construction shall be labeled or otherwise identified as conveying wastewater. Green detector tape clearly labeled "sanitary sewer" shall be laid a maximum of two (2) feet below finished grade and green plastic coated #10 copper wire shall be affixed to the top of the sewer main and made accessible at all valve boxes.

c. Diameter

- i. The pipe diameter of the force main shall be larger than the diameter of the maximum solid size that is passed by pumps present in the pump station.

A minimum 4-inch force main shall be used unless the force main is served by pumps capable of grinding, chopping, or cutting solids or a mechanical means of reducing the size of a 3-inch solid and any trash or stringy material that can pass through a 4-inch stainless steel pipe installed in the pump station. Acceptable mechanical means of solids reduction shall be as defined in 15A NCAC 02T regulations.

d. Velocity

- i. Wastewater velocity occurring in a force main shall be calculated using the continuity equation:

$$V = 0.409Q/D^2$$

V = velocity (feet per second)

Q = pumping rate of a single pump (gpm)

D = diameter of the pipe segment (inches)

- ii. A self-cleansing velocity of at least two (2) feet per second shall be provided throughout the length of the force main in accordance with 15A NCAC 2H .0219(i)(2)(B).

a. Consideration shall be given to preventing or alleviating the accumulation of solids in the force main by providing one or more of the following:

- i. The ability to provide velocities of between two (2) and five (5) feet per second during a cleaning event that are suitable to resuspend any solids that may have settled out.
- ii. Drain or blow-off valves provided at all low points in the force main. Such valves shall be connected to an available entry point into the wastewater collection system, provided with a connection for a vacuum pumper truck, and designed with some other method to prevent an intentional discharge of wastewater during their operation.
- iii. Flushing ports along the length of the force main as well as a water supply of sufficient quantity and pressure. Such ports shall either be connected to an available entry point into the wastewater collection system, provided with a connection for a

vacuum pumper truck, and designed with some other method to prevent an intentional discharge of wastewater during their operation.

- iv. Pigging device launching and retrieval stations of a size sufficient to clean the inside diameter of the force main.

- b. Compliance with NCDEQ's Minimum Design Criteria for the Fast-Track Permitting of Pump Stations and Force Mains Section 4.03 B.1 shall also be required when engineering calculations determine that depressed sections of the force main will not be completely flushed in a single pumping cycle.

- iii. Anchorage

- a. Force mains shall be adequately anchored to resist thrusts that may develop at bends, tees, valves, fittings, plugs, and any other location where a change in flow direction occurs.

- i. Such anchoring shall be provided by using concrete thrust blocking and/or restrained joint pipe.

- 1. Concrete thrust blocks shall be located between the fitting to be anchored and undisturbed soil material. Appropriate thrust reaction block bearing areas shall be calculated based not only on the maximum expected force but also on the soil material. Concrete thrust blocks shall have a minimum compressive strength of 3,000 pounds or greater per square inch.

- 2. Concrete thrust blocking, anchoring, or pour in -place concrete shall not encase any fitting or bolts.

- 3. Self-restrained joints or joints restrained with tie rods and clamps shall both be acceptable. In both cases, component parts shall either be manufactured with corrosion-resistant materials or coated liberally with a corrosion-retarding product.

- ii. Anchoring devices shall be designed to withstand force main pressures of at least 25% greater than the maximum pump shut-off head, plus an allowance for water hammer and an appropriate factor of safety.

- e. Surge and Water Hammer

- i. Consideration shall be given to analyzing force mains in conjunction with their associated pump stations with respect to the development of hydraulic transients.

- ii. Force main design shall be such that active devices for control of transient hydraulic conditions are minimized to the greatest extent possible; however, if this is not feasible, the following shall be acceptable control strategies:

- a. Providing air scouring velocities in the force main.

- b. Construction of the force main using a higher-strength pipe.

- c. Vacuum relief valves in accordance with NCDEQ's Minimum Design Criteria for the Fast-Track Permitting of Pump Stations and Force Mains Section 4.05.
- d. Specialized control and/or release valves and other devices designed to prevent transient pressures from reaching levels that could damage the pump station and force main systems.
- f. Appurtenances

#### Air Release Valves

- a. The route of the force main shall be such that the number of air release valves are minimized to the greatest extent possible.
- b. In accordance with 15A NCAC 02T .0305(h)(5), an air release valve shall be provided at all high points to prevent air locking of the force main. NCDEQ has interpreted this regulation as requiring an air release valve at locations where the distance between the low point and high point in the force main exceeds ten (10) vertical feet.
  - i. Automatic air release valves shall be acceptable.
  - ii. Automatic air release valves with flood protection in areas within the 100-year floodplain or anywhere flooding is anticipated to occur.
  - iii. Automatic air valves shall be of the quick-opening, slow-closing type to prevent the development of hydraulic surge conditions.
- g. Force mains shall be installed with a minimum cover of three (3) feet measured from the top of the pipe to the finished subgrade.
- h. Dedicated easements for force mains and appurtenances shall be recorded as "PLURIS Utility and Pipeline Easement" or "PLURIS Sanitary Sewer Easement." PLURIS sewer easements shall not contain any other utilities.
- i. Force mains shall discharge at the invert of the receiving manhole and shall be as close as possible to 180 degrees from the outlet pipe.
- j. Sewage air release valves shall be installed at all the high points or runs exceeding 3,000 feet on all force mains in accordance with the Standard Details.
- k. A gate valve shall be installed every 1,000 feet of force main length with full accessibility unless otherwise directed by PLURIS. At least two (2) gate valves shall be installed at every tee junction.
- l. A hammerless cast iron check valve shall be installed at each tap. It shall be connected directly to the gate valve after the tap has been made on the receiving force main. Hammerless check valves may be direct burial.
- m. All air release valves, plug valves, or other fittings or appurtenances that have moving or operating parts and require maintenance and routine access shall have a manhole placed over

them or over the operating portion of the device. Manholes shall be designed and installed as described in Section 7.0 of PLURIS Standard Specifications.

- n. Refer to Part I and Part II of PLURIS Standard Specifications for more details on easements, separation distances, bedding requirements, and any other installation requirements.

### 3. Construction

- a. DIP force main may be cored if necessary, using an appropriately sized tapping sleeve.
- b. PVC C9-00 pipe will require the installation of a detector tape placed a maximum of two (2) feet below the surface. #10 gauge copper tracer wire with green plastic coating will be laid with all force mains and made accessible at all valve boxes.
- c. Force mains shall be appropriately identified upon installation so they will not be confused with potable waterlines or other utilities.
- d. Reaction blocking for all fittings or components subject to hydrostatic thrust shall be securely anchored using concrete thrust blocks poured in place and shall not encase the fittings.
- e. Force mains shall be installed with a minimum cover of three (3) feet measured from the top of the pipe to the finished subgrade.
- f. Force main valves shall be spaced at appropriate intervals as determined by PLURIS and shall have valve box caps marked "Sewer." All valves shall be clearly indicated on as-built drawings.
- g. The receiving manhole for a force main shall receive an interior coating of a suitable cold tar epoxy approved by Pluris with a total dry film thickness of ten (10) mils. The force main shall discharge at the invert of the receiving manhole and shall be as close as possible to 180° from the outlet pipe.
- h. Installation
  - i. Joints and Bedding

- a. Force mains shall be installed such that pipe and joint deflection is minimized.

- i. Force mains of DIP shall be installed in accordance with AWWA C600 "Installation of Ductile Iron Water Mains and Their Appurtenances."
    - ii. Force mains of PVC C-900 pipe shall be installed in accordance with AWWA C605 "Installation of Underground Installation of PVC C-900 Pipe and Fittings for Water."
    - iii. Force mains of HDPE pipe shall be installed as described in NC DENR's "Minimum Design Criteria for the Fast-Track Permitting of Pump Stations and

Force Mains" Section 4.01B.3.e. Contractors shall be fully trained and qualified by the manufacturer to install HDPE pipe.

- b. Continuous and uniform bedding, haunching, and backfill that is appropriate for the soil

type and pipe material shall be provided in the force main trench.

ii. Burial

- a. A minimum burial depth of three (3) feet as measured from the crown of the pipe to the ground surface shall be provided throughout the length of the force main in accordance with 15A NCAC 02T .0305(g)(4). Consideration shall be given to utilizing a greater burial depth in locations where the frost depth exceeds three (3) feet.
- b. If the appropriate installation depth cannot be met by the design, the force main shall be constructed of ferrous metal pipe or provided with a ferrous pipe encasement in accordance with state requirements.

iii. Separations

- a. Minimum separations between pump stations/force mains and natural features, or any utilities, shall be maintained in accordance with 15A NCAC 02T.

.0305(f).

b. Stream Crossings

- i. Force mains shall be routed such that the number of stream crossings is minimized. When a stream crossing is required by the design, the crossing shall be as nearly perpendicular to the stream flow as possible.
  - ii. DIP with joints equivalent to water main standards or a watertight ferrous metal pipe for encasement shall be used to construct force mains that cross streams. The DI or encasement pipe shall be extended horizontally for a length equal to that required by 15A NCAC 02T .0305 on either side of the stream.
  - iii. Force main bedding, haunching, and backfill shall be appropriate for the installation location and pipe material. However, the ability of the bedding and backfill material to readily erode, cause siltation, damage the force main during installation, and corrode the force main after installation shall also be considered.
  - iv. No aerial stream crossing of force mains will be permitted. All stream crossings will be by directional bore.
- c. If the appropriate separation cannot be met by the design, the force main shall be constructed of ferrous metal pipe with joints equivalent to water main standards or provided with a watertight, ferrous metal pipe encasement. However, force mains shall not be closer than twenty-five (25) feet from a private water supply well or fifty (50) feet from a public water supply well, even if ferrous metal pipe with joints equivalent to water main standards is used.

#### 4. Testing

a. Force Main Testing

i. General

- a. Prior to testing any segment of force main, care shall be taken to prevent the pipe from moving while under pressure.

- b. Temporary taps and air releases shall be permissible to facilitate testing.
    - c. Discharge or disposal of any water used for testing force main installation into the system is not permitted by PLURIS and shall be the responsibility of the Applicant to dispose of in accordance with state and federal laws and regulations.
    - d. All testing shall be performed in the presence of the applicant, the Engineer of Record or their representative, and an authorized representative from PLURIS.
    - e. The results of all testing shall be maintained by the applicant as part of the construction record documentation as stipulated in NC DENR's "Minimum Design Criteria for the Fast-Track Permitting of Pump Stations and Force Mains" Section 1.03B.
  - ii. Force mains shall be installed in a manner such that pipe deflection is minimized.
  - iii. Pressure Testing
    - a. The pressure test shall be performed after the force main has been backfilled and at least seven (7) days following the pouring of the last thrust block.
    - b. The pressure test may be performed concurrently or separately with the leakage test as required in NC DENR's "Minimum Design Criteria for the Fast-Track Permitting of Pump Stations and Force Mains" Section 6.04D.
  - iv. Each layer of fill or backfill over the force main shall be compacted to a density needed to accommodate the use of the force main installation area or otherwise may be required by governmental agencies having jurisdiction, including, but not limited to, the NCDEQ, the DOT, and County.
- b. Inspections
- i. All materials and equipment used in the construction of the wastewater pumping system must be verified for compliance with the specifications (or other approval granted by PLURIS) by the developer's Engineer of Record prior to installation. Nonconforming materials or equipment shall be immediately removed from the job site.
  - ii. Compliance with plans and specifications shall be verified on a regular basis by the Engineer of Record.
- c. General
- i. The Contractor shall furnish all materials, labor, and equipment to perform all testing.
  - ii. All water or wastewater used during testing of the pump station, force main, or any of the systems described in this section must be disposed in a way that complies with all NCDEQ regulations.

- iii. Before the operational tests are conducted, the required copies of the operation. and maintenance manuals shall be delivered to PLURIS.

- iv. PLURIS reserves the right to require further testing, as necessary, to ensure that all components and infrastructure are performing in accordance with the manufacturer's recommendations and PLURIS's specifications. All testing, repairs and/or readjustments, and necessary re-testing, shall be at no additional cost to PLURIS.
- v. All on-site testing and/or installation verification shall be performed in the presence of the Inspector or other representative authorized by PLURIS.
- vi. All testing, installation verification, and training shall be performed in the presence of, or by, an experienced, competent, and authorized manufacturer's representative.
- vii. Factory testing shall consist of evaluating all operating functions of the equipment under varying operating conditions to ensure that it will perform as specified. Any specific testing that may be required is discussed under the individual equipment items below. Results of factory testing shall be presented to PLURIS prior to delivery of the equipment.
- viii. Installation verification shall consist of a visit to the site by a manufacturer's representative to inspect, check, adjust (if necessary), and approve the equipment installation. The manufacturer's representative shall certify that the equipment has been professionally installed and lubricated, is in accurate alignment, and is free from any undue stress imposed by connecting piping or anchor bolts. Any specific verification requirements are discussed under the individual equipment items provided in subparagraphs 1x., x., xi., of this section, and Part 5, below. Results of the installation verification shall be presented to PLURIS prior to start-up of the equipment.
- ix. On-site testing shall consist of all manual and automatic operating functions under various operating conditions, including full load conditions. The equipment shall also be tested under adverse or emergency conditions. All alarms and remote signals shall also be tested. Any specific testing that may be required for each individual equipment item. Results of the on-site testing shall be presented to PLURIS prior to final acceptance of the project.
- x. All functions and systems of the pump station, even those not specifically listed, shall be tested to ensure proper operation under normal and emergency situations.
- xi. All defective equipment or malfunctioning systems shall be replaced or corrected, and the full system placed in a fully operational condition to the satisfaction of PLURIS, at no cost to PLURIS.

Results of all factory testing, installation certifications, and on-site operational testing shall be provided to PLURIS in the final construction documents as described in the Submittals portion of this specification section.

## **5. Valves and Appurtenances**

- a. Check Valve: All check valves shall be iron bodied and check valves within the valve vault shall have a weighted hammer lever arm capable of being mounted on either side of the valve.

- b. Check valves being used at the tap shall have an internally weighted clapper and capable of direct burial.

- c. All piping, valves, elbows, tee, and other like fittings shall be flanged-to-flanged fittings within the valve vault.
- d. Smaller diameter taps may require a Myers CV-200 Check Valve and will require Pluris approval.
- e. All taps into a receiving force main shall utilize a stainless-steel tapping sleeve.
- f. Ball check style valves shall not be permitted.
- g. Plug Valve: Plug valves shall be eccentric action and resilient plug facing with heavy-duty stainless-steel bearings and welded in corrosion resistant nickel seal. Force main plug valves shall provide clean passage for a solid sphere of at least 67% of the adjoining pipe diameter to facilitate pigging of the force main. Force main plug valves shall be a "full port" cross-sectional area perpendicular to the flow of at least 100% of the adjoining pipe.
- h. Air Release Valve:
  - i. The valve shall be sized by a North Carolina licensed Engineer and approved by PLURIS. Information on the manufacturer's recommended sizing, along with the Project Engineer's recommendation, shall be submitted to PLURIS for review when applying for approval of the sizing.
  - ii. ARV air valves shall be of the single housing style. The valve shall have a minimum two (2) inch NPT inlet and two (2) inch ball valve and 150-psig working pressure. The valve must meet the requirements of AWWA C512.
  - iii. All ARV's inside the valve vault shall be placed atop a blind flange of a tee downstream of the valve assembly.
  - iv. All ARV associated parts for tapping and installation shall be stainless steel.

## **Part VII        Sewer Pump Stations**

### **1.        Material**

- a. Site Work - A LED light of 600-watt (min) capacity to illuminate the pump station area shall be provided. The light shall be mounted on a Class V utility pole at a height of fifteen (15) feet and controlled by means of a photocell and manual switch to bypass photocell.
- b. Piping and Valves – Suction and discharge piping shall be stainless steel flanged pipe as manufactured under AWWA Specification C 141. A weighted arm swing check valve and a gate valve shall be provided in a valve vault outside the station for the discharge pipe of each pump. A tee shall be installed in the valve vault to join each discharge pipe into the common force main line. An ARV combination air valve shall be in the valve vault downstream of the gate and check valves. In addition, a six (6) inch minimum stainless steel suction pipe and a four (4) inch

minimum DIP discharge pipe will be supplied to provide connection of a bypass pump in an emergency.

- c. Electrical - The electrical power entrance shall be through a meter base, followed by a NEMA 4X heavy duty, single throw, fusible safety switch with a solid neutral, followed by a NEMA 4X heavy duty, double throw, three pole safety switch, which feeds the control panel from one side and heavy duty, circuit breaking 4 wire, 4 pole receptacle assembly as manufactured by Crouse-Hinds or other approved equal from the other side.
- d. Control Equipment Enclosure - Liquid Level Controls – The cord connection for the control shall be numbered 16-2, rated for 13 amps, and shall be type SJTO. To ensure optimum longevity, contacts shall be rated for 20 amps at 115 V AC and shall be sealed in a heavy-duty glass enclosure.
- e. Pump Station – Submersible Pump Type
  - i. Sewage Pumps and Motors
    - a. Pumps shall be three (3) phase Myers or Flyght or another approved manufacturer submersible non-clog sewage pumps where applicable.
    - b. Grinder pump application will be subject to PLURIS approval.
    - c. The pump shaft shall be 416 stainless steel.
    - d. Power cables to pumps shall be AWG (min) Hypalon jacketed type SPC cable of thirty (30) feet in length as a minimum.
  - ii. Discharge Piping and Valves
    - a. Discharge piping inside the wet well shall be flanged stainless steel pipe and DIP inside the valve vault, sized to produce a minimum head loss while maintaining a minimum velocity of 2.5 feet per second, as herein before specified.
    - b. All hardware used inside the wet well shall be 316 stainless steel.
  - iii. Lift Out Rail System - Guide rails shall be stainless steel pipe.
  - iv. Telemetry – Mission Control Model MYDRO 150 Series wireless monitoring and alarm with manufacturers enclosure shall be required.

## 2. Design

- a. General Requirements
  - i. Sewage pumping stations shall meet the requirements as stated in this section and as described in each section for the type of station selected. Pump stations may be submersible pumps only.

- ii. All stations shall have a minimum of two (2) pumps of equal capacity. The pumps shall be 3 phase solid handling, non-clog pumps where applicable, and capable of handling flows more than the expected peak flow. Where three or more pumps are required, they should be of such capacity that with any one unit out of service, the remaining units will have capacity to handle peak sewage flows. Pumps and the sewage force main shall be sized to provide a minimum velocity in the force main of 2.5 fps.
  - iii. Grinder pump application will be subject to PLURIS approval.
  - iv. Sewage pumping stations, all related structures and controls, shall be protected from physical damage by the 100-year flood. Stations shall be designed to remain fully operational and accessible during the 25-year flood. The 100-year flood elevation shall be shown on all site plans. All lift stations with a tributary flow of 15,000 gallons per day must be equipped with an emergency self-priming Godwin bypass pump with a diesel engine and controlled by independent floats. All pump stations with less than 15,000 gallons per day tributary flow must be plumbed with ports for a mobile bypass pump. Plumbing connections shall be specified by PLURIS.
- b. Site Work
- i. The site shall be graded generally to drain away from the pump station and to remove stormwater runoff from site in a non-erosive manner.
  - ii. The site shall be stabilized by a minimum of six (6) inches of compacted crushed stone, low maintenance vegetative ground cover, or other suitable materials. A shrubbery screen shall be provided on three sides of all pump stations, outside the security fence, no closer than four (4) feet away from any side, corner, or utility structure when applicable.
  - iii. The site area shall be secured by a six (6) foot high chain link fence. Fence products shall be only new materials using hot dipped galvanized iron or steel components and aluminum coated fabric. Line posts, top and bottom rails, gate, and fabric shall be as specified on the Standard Detail Drawings. Gates shall permit 180 degree opening and shall be located to provide vehicle accessibility for lifting the pumping units. There shall be a minimum gate opening of fourteen (14) feet to facilitate Vac truck access.
  - iv. Privacy slats are to be installed in all chain link fencing.
  - v. The site shall feature an adequate turnaround area for service vehicles and provide a twelve (12) foot (minimum) wide all-weather access road to the site with grades not to exceed ten (10) feet in one hundred feet (10%). The road must consist of six (6)-inch compacted stone or concrete.
  - vi. There shall be provided a LED of 600-watt (min) capacity to illuminate the pump station area. The light shall be mounted on a Class V utility pole at a height of fifteen (15) feet and

controlled by means of a photocell and manual switch.

- c. Piping Valves - Check valves shall be iron bodied and if within the valve vault, shall have a weighted hammer lever arm capable of being mounted on either side of the valve and rated for 175 psi working pressure.
- d. Ball check style valves will not be permitted.
- e. Wet well.
  - i. The wet well shall be precast concrete manhole sections conforming to ASTM C-478, latest revision, with a six (6) foot minimum diameter. The base of the wet well shall be pre-cast, steel-reinforced concrete and have a minimum extended base of six (6) inches greater than the outside diameter of the wet well. The concrete shall have a minimum 28-day compressive strength of 3,000 psi or greater.
  - ii. The manhole sections shall have joints of a durable mastic sealing material, and the joints shall be further waterproofed on the outside of the wet well by the application of asphalt, overlapped by a 12-inch-wide band of inorganic fabric felt and a finish mopping of asphalt. The interior side of the joints shall be plastered smooth with three (3) coats of Portland cement grout. The interior and the exterior of the wet well shall then receive two successive coats of a suitable coal tar epoxy, approved by PLURIS, with a total dry film thickness of ten (10) mils. The access hatch to the wet well shall be a square hatch of ¼ inch aluminum, 6063 alloy, diamond pattern plate with steel hinges on an aluminum frame cast in place in the cover slab.
  - iii. The wet well shall have a vent made from ductile iron, flanged joint, and pipe fittings as shown on the plans. An insect screen shall be included at the exposed end of the vent pipe. The insect screen shall be stainless steel or aluminum insect screening.
- f. Electrical
  - g. All electrical panels shall be mounted on a grounded frame backboard constructed of aluminum or stainless steel.
    - i. Electrical service to all pump stations shall be three (3) phase, 240 or 480 V AC, unless approved by PLURIS. The electrical power entrance shall be through a meter base, followed by a NEMA 4X heavy duty, single throw, fusible safety switch that feeds the control panel from one side and heavy duty, circuit breaking four (4) wires, four (4) pole receptacle assembly as manufactured by the Crouse-Hinds or other approved equal.
    - ii. All electrical components shall be suitably sized to be capable of service with all sewage pumps running.
    - iii. All electrical components, including panels shall be sealed off with sealing compound in accordance with the NC electrical code requirements for electrical service to gas pumps.

- h. Pump Motor Controls - Pump motor controls equipment shall be located within a NEMA 4X stainless steel above ground housing.

i. Control Equipment Enclosure

- i. NEMA4X Enclosure - Enclosure shall be a NEMA type 4X and be of suitable size to house all components. A locking hasp shall be provided in addition to screw clamp type latches. Enclosure shall be fabricated from 14-gauge stainless steel. The top of the enclosure shall serve as a drip shield and the seam-free sides shall prevent rain and sleet from entering. The inner panel shall be made of 12-gauge steel and shall be painted white. The enclosure and interior panel shall be painted with heat fused modified polyester powder, electrostatically applied over a phosphatized base. Enclosure shall be ANSI/ASI 61 grey.
- ii. All control panels shall be Ohio Electric control panels unless approved by PLURIS. No panels will be configured with an uninterrupted power source (UPS). Panels must have independently operating relays.
- iii. Hinged Inner Door – An inner door shall be furnished. Overload reset push buttons, circuit breakers, switches, and pilot lights shall be the only components accessible with door closed. The door shall be hinged and may be opened when service is required.
- iv. Line Terminal Block – A terminal block shall be furnished with properly sized line lugs to accept the main power source entering the control panel. Load lugs shall be adequate to accept all required load side wiring requirements. All live parts shall be fully shielded.
- v. Motor Circuit Breakers (240 or 460 V AC) - A properly sized, molded case, thermal magnetic circuit breaker shall be provided for each pump motor. Line and load sides shall be equipped with lugs properly sized for the horsepower and current rating of the motor(s). They shall be attached to mounting brackets which are specifically manufactured for use with the circuit breaker. The interrupting rating shall be 10,000 RMS symmetrical amps.
- vi. Transformer Primary Circuit Breaker (when transformer is required) – A properly sized, two (2) pole, molded case circuit breaker shall be furnished ahead of the control power 120 V AC power transformer for short circuit protection and disconnecting power to the transformer. The circuit breaker shall conform to the specifications for the motor circuit breaker(s).
- vii. Control Power Transformer (When Neutral Is Not Available at Jobsite – Std. on 460 V AC) - An industrial quality control transformer shall be furnished to provide control voltage. The transformer shall be sized with an adequate KVA rating to provide 120 V AC power for all items required in the control and alarm circuits. - Transformer shall be protected in its secondary by properly sized fuses and/or circuit breaker(s).
- viii. Magnetic Contactors and Overload Relays- A magnetic contactor shall be furnished for each motor. A separate, panel-mounted, three leg (three phase) overload relay shall be supplied for each motor. Each leg of the overload relay shall be equipped with a properly sized overload heater. Contactor and overload relay shall be properly sized for the required horsepower, voltage, and phase.

- ix. Elapsed Time Meters – Six-digit, non-resettable elapsed time meters shall be mounted in the control panel enclosure to record the running time of each pump.
- x. Phase and Voltage Monitor- A phase failure, reversal and under voltage monitor shall be supplied to prevent the motors from running under low voltage, phase loss, or phase reversal conditions. The monitor will lock out the control circuit until the problem is corrected and automatically reset.
- xi. Lightning Arrestor- Suitable lightning arrestors shall be provided to protect motors and control equipment from lightning induced line surges.
- xii. Thru-Flash panel Door Overload Reset Push Buttons - Overload reset push buttons shall be provided for each overload relay. Push buttons shall be mounted so that with the inner door closed, overload relays may be reset without entering high-voltage compartment.
- xiii. Switches - Heavy duty industrial grade oiltight switches shall be provided for each pump for "Hands-Off-Automatic" operation selection. All switch components shall be made of corrosion resistant metals and polyesters. Contact blocks shall be made of see-through polycarbonate for simplified inspection of contacts. Cams and strokes shall be Teflon impregnated for abrasion free service without lubrication. The switches required shall be as follows:

Switch Function (Name Plate)	Voltage
Manual-off-Automatic	120 V AC

- xiv. Pilot Lights – Full voltage heavy duty, industrial grade, oiltight pilot lights shall be provided. All pilot light components shall be made of corrosion resistant metals and polyesters. An insulated socket shall be furnished to eliminate the possibility of shock during bulb change. Lens shall be made of Lexan. The pilot lights required shall be as follows:

Pilot Light	Voltage	Lens Color
Function (Name Plate)	Voltage	
PUMP 1	120 V AC	GREEN
PUMP 2	120 V AC	GREEN

- xv. Seal Failure Circuit Test Push Button (illuminated) - Heavy duty, industrial grade, oiltight push buttons shall be provided for each submersible pump motor. All push button components shall be made of corrosion resistant metals and polyesters. Contact blocks shall be made of see-through polycarbonate for simplified inspection of contacts. An insulated socket shall be furnished to eliminate the possibility of shock during bulb change. Lens shall be made of Lexan.

The push buttons required shall be as follows:

Pilot Light Function (Name Plate)	Voltage	Lens Color
P1 SEAL FAIL	120 V AC	AMBER
P2 SEAL FAIL	120 V AC	AMBER

- xvi. Pump Alternator Circuit (for duplex pump operation) - The electromechanical alternator relay shall be of industrial design specifically for use in pump applications. It shall have single pole, double throw heavy duty, 10-amp, silver cadmium oxide contacts enclosed in a transparent cover. The contacts shall transfer when the unit is deenergized. The circuit shall never be closed or opened while current is being conducted. The alternator circuit shall alternate the lead pump position between the pumps and shall allow the lag pump to start in response to a rising water level in the wet well. Needs to be switchable I.E. P1 or P2 lead. (P1 alt. P2).
- xvii. Power Failure - Once power is restored after a failure and the pump has pumped the water from alarm level down to pump off, the alarm should automatically reset itself.
- xviii. Control Relay(s) - Plug-in control relays with 120 V AC coils shall be provided as required. Contact rating shall be five amps (minimum). Sockets shall be from the same manufacturer, and the relays and hold-down clips shall be furnished to prevent relay from sliding out of the socket.
- xix. High Wet Well Level Alarm - The control panel shall be provided with a suitable alarm circuit, activated by a separate level control. This alarm shall signal a high-water condition in the sump. Terminals shall be furnished in the control panel for connection of an externally mounted alarm device.

A red flashing light shall be provided as a visual alarm and a horn provided as an audible alarm of the high-water condition in the wet well. The pump station shall also be equipped with buttons to both test and silence the horn and light.

- xx. Liquid Level Controls - Mercury level control switches shall be provided for pumps on, lead pump on, lag pump on, and high-level alarm functions. The mercury switch shall be encapsulated in polyurethane foam for corrosion and shock resistance. Level switches shall be weighted to hold desired position in the sump. The cord connection for the control shall be numbered 16-2, rated for thirteen (13) amps, and shall be type SJTO. To ensure optimum longevity, contacts shall be rated for twenty (20) amps at 115 V AC and shall be sealed in a heavy-duty glass enclosure. No junction boxes or cable splices of any kind will be allowed in the wet well. Float leads shall not be in the same conduit as the motor leads.
- xxi. High Temperature Shutdown Circuit(s) - The high pump motor temperature circuit shall provide terminals for connection of the leads from the temperature sensor provided in the pump motor windings. Upon a high temperature condition in the pump windings, the control power to the pump motor contactor shall be disconnected, thus stopping the pump motor. An overheating light shall come on, and the pump shall automatically restart when the pump motor temperature returns to an acceptable level.
- xxii. Ground Lug(s) - Equipment ground lug(s) shall be provided for grounding the enclosure. The ground lug(s) shall be suitable for the service provided to the enclosure and shall be sized per table 250-95 of the N.E.C. In all cases the enclosure must be adequately grounded per article 250 of the N.E.C.
- xxiii. Terminals - Terminals shall be provided for connecting mercury float switch leads, temperature sensor leads, and seal fail sensor leads. Terminal blocks shall be rated for 600 volts use and accept a wide range of #22-8. All live parts shall be fully shielded. Block shall be constructed of nylon and have insulating walls on all sides of the lug. Blocks must be UL recognized.
- xxiv. Construction Standards - Subpanel shall be drilled and tapped to accept machine thread bolts (self-tapping screws are not acceptable). All control wiring shall be 16 AWG machine tool wire, Carol type 76512 or equal. All control wire shall be color coded or numbered in accordance with JIC standards. Power (motor) wiring shall be in accordance with the 1984 National Electrical Code. Major groups of wires shall be contained in a plastic wiring trough such as Panduit Type E or other approved equal.
- xxv. Guarantee- The manufacturer of the control panel shall furnish a warranty for one year from the date of start-up stipulating that all equipment shall be free from defects in design, materials, and workmanship. The control panel manufacturer shall furnish replacement parts for any component proven defective, whether of the control panel manufacturer or other manufacturer during the guarantee period, excepting only those items that are normally consumed in service, such as light bulbs.
- xxvi. Panels must be equipped with dry contact terminal boxes for telemetry.

j. Pump Station – Submersible Pump Type

- i. General - The submersible pump station structure shall consist of the wet well, duplex pumps and rails, pump controls and related appurtenances, discharge piping, valves, valve vault, cover slabs, and access hatches.

The wet well shall have a minimum diameter of six (6) feet and shall be large enough to easily accommodate the location and removal of each pump so that no pump will have more than five (5) starts per hour when the other pump is out.

- ii. Sewage Pumps and Motors - Pumps shall be Myers, Flygt, or other PLURIS-approved manufacturer, submersible, large grinder or non-clog sewage pumps, or a pump approved by PLURIS's engineer. Submersible pumps shall be provided with each capable of handling raw, unscreened sewage at peak design flow. Major pump components shall be of gray cast iron devoid of burr, pits, or other irregularities. The pump motors shall be sealed, submersible type and shall be three (3) phase, 60 Hertz, 240- or 460-volt motors with a wye connection. The motors shall meet the U. S. requirements of Class I, Division I, and Group D for hazardous locations and shall be sized to non-overloading throughout the entire operating range of the pump.

Stator winding shall be of the open type with insulation good for 1,800 centigrade maximum temperature. Winding housing shall be filled with a clean high dielectric oil that lubricates bearings and seals and transfers heat from windings and rotor to outer shell.

Motor shall have two (2) heavy duty ball bearings to support the pump shaft and be capable of handling radial and thrust loads and a sleeve guide bushing directly above the lower seal to manage the radial load and function as flame path for seal chamber. Ball bearings shall be designed for 30,000 hours B-10 life. Stator shall be heat shrunk into motor housing.

A heating sensor thermostat shall be attached to and embedded in the winding and be connected in series with the motor starter contactor coil to stop motor if temperature of winding is more than 220° F. Thermostat shall reset automatically when motor cools to safe operating temperature. The common pump shaft shall be of 416 stainless steel.

The pump motor shall be protected by two (2) mechanical seals mounted in tandem with a seal chamber between the seals. Seal chamber shall be oil filled to lubricate seal face and to transmit heat from shaft to outer shell. Seal face shall be carbon and ceramic and lapped to a flatness of one light band. Lower seal faces shall be tungsten carbide.

A double electrode shall be mounted in the seal chamber to detect any water entering the chamber through the lower seal. Water in the chamber shall cause a red light to turn on at the control panel. This signal shall not stop the motor but shall function as a warning only.

Power cables to pumps shall be AWS (mm) Hypalon jacketed type SPC cable of thirty

(30) feet in length as a minimum.

- iii. Discharge Piping and Valves - Discharge piping shall be flanged stainless steel pipe inside the wet well and DIP on the inside of the valve vault and sized to produce a minimum head loss while maintaining a minimum velocity of 2.5 feet per second, as herein before specified. All exposed piping shall have adequately sized stainless steel thrust rods.

The discharge connection elbow shall be a straight through fitting with no flap valve and shall be permanently installed in the wet well along with the discharge piping. The pumps shall be automatically connected to the discharge connection elbow when lowered into place. A sliding guide bracket shall be guided no less than two (2) guide bars. The entire weight of the pump shall bear upon the guides and base support with no part of the pump bearing directly on the floor of the sump. A stainless steel chain shall be provided for lifting each pump from the wet well and shall be in a single length and extend a minimum of fifteen (15) feet past the hatch. All hardware used shall be 316 stainless steel.

Gate valves and check valves on the discharge side of each pump shall be in a valve vault separate from and adjacent to the wet well. A mechanical joint coupling shall be installed on each discharge main between the wet well and the valve vault. The valve vault shall consist of a precast rectangular structure at least six (6) feet square, all complete with a drain that goes to the wet well and that has a flapper style valve on the drain line, access ladder or rungs, and access cover cast in the top slab.

The access cover for the valve vault shall be a square hatch of 1/4 inch aluminum diamond pattern plate with stainless steel hinges on an aluminum frame cast in place in the cover slab.

- iv. Lift Out Rail System - The lift out systems shall consist of a straight elbow that bolts to bottom of basin, a combination disconnect assembly with a seal flange that mounts to pump, rail support guides that fasten to wall of basin and guide and support brackets that mount to pump.

Guide rails shall be Stainless steel pipe.

The discharge quick disconnect shall be tapered and have a holding groove machined into the face to hold a-sealing--O-ring. The tapered seat shall allow the pump to be nearly sealed to the discharge elbow before the sealing faces make contact. A guide plate and adjustable guide bar shall be fastened to the top of the pump to ensure good alignment and for support of the pump.

The rail support and mounting bushing shall be securely mounted to the basin wall and shall not be attached to the basin cover or cover frame.

The guide rail support shall be adjustable so that a perfect vertical alignment of the rails can be obtained.

- k. Warranties and Documentation

- i. Warranties - The pump manufacturer shall warrant to the Developer and subsequently PLURIS, that the pumps, motors, and controls supplied are free of defects in workmanship and material for a period of one (1) year. The warranty shall be in printed form and made applicable to PLURIS (as Warrantee) at the time of acceptance for maintenance by PLURIS. Digital and hardcopy drawings of the as-builts shall be provided to PLURIS. The drawings shall contain all adjacent utility information including, but not be limited to, force mains, valves, and gravity sewer manholes.
- ii. Documentation – Documentation to be supplied to PLURIS shall be three copies of the complete Operation and Maintenance manuals, which include the following:
  - a. Cover Sheet Listing: Pump manufacturer; source of repair parts, complete with address and phone number; operating conditions – rated capacity and TDH of each pump; model number, serial number, impeller diameter of each pump; all data plate information from each pump motor; and data on other equipment included as components in the pump station.
  - b. Pump performance curve with operating conditions indicated on it.
  - c. Detailed dimensional drawings of the pump and pump base elbow.
  - d. Detailed dimensional drawings of the pump motor.
  - e. A control panel wiring diagram.
  - f. Pump and motor installation and service manual.
  - g. Detailed information related to other components of the pump station.
- I. Pump Design
  - i. General Requirements
    - a. Only pumps designed and manufactured for use in conveying raw, unscreened wastewater shall be acceptable.
    - b. Pump selection shall consider the duty requirements as well as the physical and chemical characteristics of the wastewater being conveyed. Materials used in pump construction shall also be suitable for the physical and chemical characteristics of the wastewater being conveyed.
    - c. Pump stations conveying residential, commercial, institutional, or industrial domestic wastewater shall be provided with pumps that are suitable for continuous duty in conveying raw, unscreened wastewater.
      - i. Pumps shall be three (3) Phase and capable of handling a three-inch solid and any trash

or stringy material that can pass through a four-inch pipe unless a mechanical means of solids reduction is installed at the pump station.

1. Pumps shall be approved by PLURIS. Impellers shall have blades that are generally forward rounded or otherwise configured to avoid catching solids, trash, and stringy material.
  2. Mechanical bar screens, communicators, dominators, or other similar devices may be required at regional pump stations.
- ii. Pump suction and discharge openings shall be no less than four (4) inches in diameter (unless approved by PLURIS), the pump is capable of grinding, chopping, or cutting solids or a mechanical means of reducing the size of a three-inch solid and any trash or stringy material that can pass through a four-inch pipe in the pump station.
  - iii. Pumps shall be designed for continuous duty pumping of raw, unscreened wastewater. Pumps shall be adequately protected from damage due to failure conditions specific to the selected pump type and pump station configuration.
- ii. Number and Capacity
    - a. Pump stations shall be provided with the number and capacity of pumps that are stipulated in 15A NCAC 02T .0305(h)(1).
      - i. Multiple pumps shall be used such that the pump station can convey the peak hourly wastewater flow to its desired outfall location with the largest single pump out of service.
        1. In duplex pump stations, the pumps shall be of the same capacity.
        2. If pumps in series are required to meet capacity or total dynamic head requirement, each set of pumps in series shall be viewed as a single pumping unit.
        3. Priming pumps as well as any other auxiliary system that is required for pump functionality shall also be provided in multiple numbers.
      - ii. Determination of pump capacity shall be based on wastewater flows expected to become tributary to the pump station for the entire project/development at build out. For regional pump stations, pump capacity shall be based on wastewater flows expected to become tributary from the entire service area over the life of the pump station.
        1. Interim sizing of pumps and associated pump stations shall be allowable providing Pluris accepts this. At a minimum however, it shall only be used to meet requirements as set forth in 15A NCAC 02T .0305 or the minimum design criteria contained in this document and not for economic purposes.
        2. A conspicuous statement that specifies the initial service capacity shall be provided on the drawings for projects that are approved for an interim condition. Additional wastewater flows (i.e., those more than that approved for the interim condition) shall not be made tributary to the pump station until a request for permit modification is submitted to and approved by NCDEQ, the pumps and associated pump station are upgraded, and

the required certificate of completion and other supporting documentation are received by NCDEQ.

iii. The minimum allowable design daily wastewater flow to the pump station shall be determined in accordance with 15A NCAC 02T .0305.

1. Where a pump station is designed to serve a developed service area, historical potable water use, or wastewater flow generation data may be used to determine design daily wastewater flows.
2. Where a pump station is designed to serve a broad service area for which specific development is not known, design daily wastewater flows may be established based on historical data for the broad service area or established long-range wastewater planning criteria.

iv. The selected peak hourly wastewater flow to the pump station shall be appropriate for the service area as well as the associated wastewater generation patterns and population being served by the pump station. The minimum peak hourly wastewater flow to the pump station shall be calculated using the design daily wastewater flow in conjunction with a peaking factor determined from the following equation:

$$PF = Q_{phf} / Q_{ddf} = [(18 + \sqrt{P}) / (4 + \sqrt{P})] \text{ Where:}$$

PF = Peaking Factor

$Q_{phf}$  = Peak hourly flow (gpd)  $Q_{ddf}$  = Design daily flow(gpd)

P = service population(thousands)

1. The above equation yields a peaking factor that is intended to cover normal infiltration and inflow for well-maintained sewer systems and/or those built with modern materials and construction methods. Consideration shall be given to applying higher peaking factors for special conditions including but not limited to such conditions as pump stations serving older collection systems, those serving collection systems located in areas with high actual groundwater tables, and those serving areas and that may have combined sewer systems. Infiltration and inflow allowances shall be incorporated using actual flow data whenever possible.
2. Peaking factors for pump stations conveying industrial or other process wastewater shall be determined based on actual operating conditions of the facility; however, in no case shall the peaking factor be less than the minimum set forth in NC DENR's Minimum Design Criteria for the Fast-Track Permitting of Pump Stations and Force Mains Section 2.02A.4.c.
3. In no case shall a peaking factor less than 2.5 be used to calculate peak hourly wastewater flows for any pump station.

### iii. Selection Methodology

- a. Pump selection shall be based on a hydraulic analysis of the system through which the wastewater is to be conveyed.
  - i. The design operating point(s) of the pump(s) shall be determined using a pump curve-system curve analysis. Pumps shall be capable of pumping the required capacity, as described in NC DENR's "Minimum Design Criteria for the Fast-Track Permitting of Pump Stations and Force Mains" Section 2.02, for all total dynamic head requirements developed by the system for the lifetime of the pump station.
  - ii. A system curve, plotting total dynamic head versus capacity, shall be developed for all operating conditions that may be imposed on the system. Total dynamic head requirements for the system shall be calculated as the total of the following individual components:
    1. Static head requirements of the system, including those associated with both the suction and discharge sides of the pumps, shall be evaluated. In addition to calculating static head with the discharge evaluation of the force main, any intermediate high points in the force main that would influence the total dynamic head requirements of the pump shall be analyzed.
    2. Friction head requirements of the system, including those associated with both the suction and discharge sides of the pumps, shall be evaluated. The friction head shall be calculated using the Hazen-Williams formula:

$$h_f = L [ 4.73Q^{1.85} / C^{1.85} D^{4.87} ]$$

Where:

$h_f$  = Friction head in feet

L = Length of the pipe segment in feet

Q = Flow rate in gpm.

C = Hazen Williams coefficient

D = Inside pipe diameter in inches

All operating conditions shall be evaluated including, but not limited to, multiple pump operation within the subject force main, simultaneous pump station operation for common force main situations, and the possibility for gravity flow conditions in force main segments with extreme negative slopes that may not flow full.

3. Hydraulic head derived from any minor losses of the system, including that associated with both the suction side and discharge side of the pump, shall be evaluated. Such minor losses shall include hydraulic head derived from valves and other fittings including but limited to tees and bends.

- iii. If applicable, the pressure head at the junction of the existing force main shall also

be evaluated for its effect on the total dynamic head requirements of the system. The evaluation shall consider the effects of simultaneous pump station operation, as well as multiple pump operations in other pump stations.

- iv. System curves shall be generated and evaluated not only for present day conditions but also for conditions that may exist over the expected lifetime of the pump station.
- v. The Hazen-Williams friction coefficient,  $C$ , appropriate for the force main pipe material and age of the force main shall be used. The following maximum values shall be allowable for  $C$ :

Pipe Type	Initial Service $C$	End-of-Service $C$
DI	125	100
PVC	140	120
HDPE	140	120

- vi. Friction head and minor losses associated with the system shall be evaluated at both the initial service condition and the end-of-service condition.
  - vii. The design operating point(s) shall be defined as the intersection of the pump curve and the calculated system curve(s).
  - viii. Pumps shall be selected such that all design operating points are on the pump curve as supplied by the pump manufacturer. In addition, pumps shall be selected such that the net positive suction head available ( $NPSH_A$ ) shall be greater than the net positive suction head required ( $NPSH_R$ ) at each of the design operating points.
  - ix. Pumps shall be selected such that the pumps will not cavitate at any of the design operating points. Pumps that operate within the unstable portion of the pump curve under any of the expected design conditions shall not be allowed. Freewheeling (i.e., operating at pump run-out) or deadheading (i.e., operating at pump shut-off) of pumps shall not be allowed.
  - x. To the greatest extent possible, pumps shall be selected such that their operating efficiency is maximized during all hydraulic conditions that may exist over the expected lifetime of the pump station.
- b. Consideration shall be given to minimizing motor speeds during the pump selection process.
  - c. The horsepower rating of each pump motor shall be at least 1.15 times that required by the pump when operating at all design operating conditions.
- iv. Cycle and Pump Run Times
    - a. Constant speed pumps shall be cycled such that the number of starts is minimized, and resting

times are maximized to avoid overheating and overstressing of the pump motor.

- i. Automatic pump alternation shall be provided in the control panel for the proper alternation of the pumps. .
- ii. Pumps shall be designed to operate between two and eight times per hour at design daily flow in accordance with 15A NCAC 02T .0350(h)(1) whenever practicable (see NC DENR's "Minimum Design Criteria for the Fast-Track Permitting of Pump Stations and Force Mains" Section 2.04A.2.b.).
  - 1. The following equation shall be used to determine the active storage volume in the pump station (i.e., the volume between the pump-on and all pump-off elevations) required to elicit the required pump cycle time:
 
$$V = T Q_{ddf} [1 - (Q_{ddf}/Q)]$$

V = active volume within the pump station (gallons)  
 T = allowable cycle time between starts (minutes)  
 Q<sub>ddf</sub> = design daily flow to pump station (gallons per minute)  
 Q = pumping rate of a single pump (gallons per minute)
  - 2. If the wastewater generation patterns are such that less than two pumping cycles per hour will occur at design daily flow or if the pump station is intended to provide equalization of hydraulic surges, measures to control odor and corrosion shall be employed when resultant detention times cause septic conditions. These measures shall take into consideration protection of the pump station, the force main, the outfall sewer, any related appurtenances, and the surrounding area.
- b. Consideration shall be given to using variable speed pumps for main pump stations or those pump stations that discharge directly into the wastewater treatment facility.
- c. Pump run times shall be such that excessive wear of the pumps does not occur.
- d. At design daily flow, adequate time shall be provided to allow a constant speed pump to "ramp up" to full speed before the pumping cycle ends.
- e. Pump run times at design daily flow shall not be less than or greater than those recommended by the pump manufacturer.
- m. Pump Station Design
  - i. General Requirements
    - a. Pump stations shall be designed to achieve total containment of the influent wastewater prior to being conveyed through the force main
    - b. Pump stations shall be designed such that infiltration and inflow are minimized.

- c. Precast polymer concrete may be utilized.

ii. Site Selection

a. Location and Access

- i. Pump station sites shall be accessible by an all-weather roadway in accordance with 15A NCAC 02T .0350(h)(4)
  - 1. The roadway shall be a solid surface road. The minimum acceptable surface shall be a six (6) inch compact gravel base able to support large commercial vehicular traffic loads that do not cause deflection.
  - 2. Wherever practicable, no portion of the roadway shall be located below the 100-year flood elevation as identified on the most recent FEMA Flood Insurance Rate map when available or as established through appropriate modeling techniques.
  - 3. The roadway shall be designed to accommodate the largest vehicle expected to service the pump station. In no case shall the roadway be less than fourteen (14) feet in width.

b. Security

- i. Access to the pump station structures as well as all associated equipment and appurtenances shall be restricted in accordance with 15A NCAC 02T.0350(h)(4)
  - 1. All ports of entry into pump station, valve vault, electrical panels shall be locked.
  - 2. Fencing provided around pump station structures shall be of sufficient height and material to deter entry. Locked gates, a minimum of fourteen (14) feet wide, shall be provided in the fence to allow vehicular access by operation and maintenance staff. Consideration shall be given to complying with the requirements in Section 3.02B.1.c. as well. All chain link fencing shall use privacy slates.
  - 3. There shall be no overhead obstruction above the pump station to allow the use of a boom truck at the pump station for lifting pumps. Additionally, stainless steel chain shall be used for lifting out the pumps, and the cable shall be in a single length and able to extend fifteen (15) feet above the wet well hatch.
- ii. The pump station shall be provided with adequate outdoor and indoor lighting to facilitate normal and emergency operation and maintenance activities during daylight and non-daylight hours.
- iii. Safety placards for all pump station structures and equipment, as required by OSHA,

shall be provided and be readily visible.

### iii. Structural Design

#### a. Materials of Construction

- i. Pump station structures shall be designed and built in complete compliance with all applicable state, local, and federal codes as well as any applicable OSHA standards.
- ii. Material selection for pump station structures shall be based on installation and operating factors including, but not limited to, the following:
  1. Physical, chemical, and biological wastewater characteristics.
  2. Corrosive gas production.
  3. Soil characteristics.
  4. Groundwater presence.
- iii. Pump station structures shall be completely separated unless made completely watertight and gas tight.
- iv. Pump station structures shall be adequately protected to minimize damage from vehicular traffic.

#### b. Buoyancy Protection

- i. Below-ground pump station structures shall be protected from flotation due to buoyant forces of groundwater.
- ii. Buoyancy protection shall be demonstrated using flotation calculations.
  1. Flotation calculations shall be performed on below-ground pump station structures using the assumption that the elevation of the groundwater table is equivalent to the ground elevation.
  2. Flotation calculations shall not add the weight of the pumps, internal piping and appurtenances, or wastewater present in the pump station, including the wastewater below the "all pumps-off" activation level into the downward forces used to counteract buoyancy.
  3. The use of the saturated weight of any soil above the extended footing of the pump station structure shall be allowed in the flotation calculations.
- iii. Flotation calculations shall show that the design of the below-ground pump station

structures will be protected from buoyancy with a factor of safety that is equal to or greater than one.

c. Flood Resistance

- i. Pump station structures and all associated equipment and appurtenances shall be protected from the 100-year flood, in accordance with 15A NCAC 02T .0350(e).
- ii. Such protection measures shall ensure that the pump station remains fully functional, operational, and free from physical damage during a 100-year flood.
- iii. The pump station shall be protected from inundation of floodwaters by elevating structures at least two (2) feet above the 100-year flood elevation. An alternate design shall include providing all pump station structures with watertight ports of entry as well as electrical, instrumentation/control, and ventilation systems that are elevated at least two (2) feet above the 100-year flood elevations.

iv. The 100-year flood elevation shall be that as identified on the most recent FEMA Flood Insurance Rate map when available or as established through appropriate modeling techniques.

d. Solids Collection

- i. Wet wells shall be designed to minimize pump or pump suction piping operational problems resulting from the accumulation of solids and grit material within the wet well.
  - 1. Acceptable designs include the use of fillets and sloped wet well floors alone or in conjunction with a hopper bottom.
  - 2. The design of fillets and slopes shall be such that solids are effectively moved toward the pump or pump suction piping.
- ii. No projections within the wet well, which would allow deposition of solids under normal operating conditions, shall be allowed.

e. Depth

- i. Pump Submergence Depth
  - 1. Sufficient submergence of the pump or pump suction piping shall be provided to prevent the occurrence of vertexing within the wet well.
  - 2. In no case shall the "all pumps-off" activation level be less than the minimum level required for successful pump operation, as recommended by the pump manufacturer.
- ii. The wet well shall be provided with a depth as required to maintain the active storage volume as required in Section 2.04A.2.a of the NCDEQ Minimum Design Criteria.

- iii. The wet well shall be provided with a depth required to maintain the emergency storage volume as required in Section 5.04B.3 and Section 5.04B.4. of the NCDEQ Minimum Design Criteria.

#### iv. Piping and Valves

##### a. Suction and Discharge Piping Configurations

- i. Each pump shall be provided with separate suction and discharge piping systems.
  - 1. Pump suction and discharge piping shall be no less than four (4) inches in diameter unless the pump capable of grinding, chopping, or cutting solids or a mechanical means of reducing the size of a three-inch solid and any trash or stringy material that can pass through a four-inch hose is installed in the pump station. Acceptable mechanical means of solids reduction shall be as defined in Section 2.01C.1.b of the NCDEQ Minimum Design Criteria.
  - 2. The ultimate pump suction and discharge piping size shall be selected such that a velocity of between two (2) and eight (8) feet per second is achieved.
- ii. The discharge piping systems shall be provided with sufficient valves so as not to affect the proper operation and maintenance of the pump station during both normal and emergency conditions.
  - 1. Selected valves shall be suitable for use with raw, unscreened wastewater and shall be of a design suitable for its function, its installation location, as well as the normal and maximum operating pressures expected at the pump station.
    - i. A full-closing, shut-off valve shall be provided on the discharge piping of each pump and on the suction piping of each dry well pump.
    - ii. A swing check valve with weighted hammer lever shall be provided on the discharge piping of each pump between the pump and the shut-off valve. Check valves shall be placed in the horizontal position.
    - iii. No ball check style valves are permitted.
  - 2. All valves shall be located such that they are readily accessible. Valves shall be placed either in the dry well or in a separate valve vault.

##### b. Pipe Connections

- i. Pipe inlets and outlets of pump station structures shall be made watertight.
- ii. Existing pump station structures shall be core drilled or saw-cut when connections are made through the structure wall. In no case shall penetrations into pump station structures be made by hammering.

- iii. A minimum two (2) inch diameter PVC schedule eighty (80) conduit shall be installed for the float switch cords.
- c. Water Service
  - i. Wherever practicable or required by the design, potable or reclaimed water service shall be provided to the pump station.
  - ii. Cross-connection control for potable water services shall be provided in accordance with 15A NCAC 18C .0406(b). Cross-connection control for reclaimed water services shall be provided in accordance with 15A NCAC 02T .0909(f).
- d. Pig Launching/Retrieval Stations
  - i. When pig launching and retrieval stations are made part of the pump station, their design shall be such that they may be isolated from the force main.
  - ii. The design of the pig retrieval station shall be such that accumulated material dislodged from the force main may be safely removed and disposed.
- v. Appurtenances
  - a. Consideration shall be given to protecting pump station structures and equipment from physical damage or clogging from solid material normally present in wastewater by screening and other solids reducing equipment.
  - b. Pump Removal Methods/Equipment Provisions shall be so that the largest piece of equipment installed at the pump station may be removed. Such provision may include supplying hoisting equipment and/or designing sufficient clearance around the pump station for mobile hoisting equipment access. All lift stations shall have a hand operated stainless steel hoist installed for submersible pump removal unless the size of the pumps make it impractical to do so. In such cases, PLURIS staff shall be consulted on the appropriate method of emergency pump removal.
    - ii. Pump station structures shall be provided with access hatches, doors, and skylights of sufficient size such that the largest piece of equipment may be removed without damaging the integrity of the structural design.
    - iii. Pump stations utilizing submersible pumps installed in wet wells shall be provided with a system that allows for the removal and installation of the pumps without requiring entry into the wet well.
      - 1. Each pump shall be provided with a guide rail system and a lift-out chain.
      - 2. Both the guide rail system and the lift-out chain shall be capable of withstanding the forces required to disengage the pump from the wet well.

3. Both the guide rail system and the lift-out chain shall be manufactured of stainless steel. Under no circumstances shall steel or galvanized steel be used.

c. Access Equipment

- i. Each pump station structure shall be designed such that access to perform routine and emergency operation and maintenance is easy, unobstructed, and safe.
- ii. Each pump station structure shall be provided with a separate means of access. Under no circumstance shall access to the wet well be provided through a dry well.
- iii. Steps, ladders, stairs, landings, hatches, and other means of access shall conform to OSHA standards as well as all applicable local and state building codes regarding design characteristics.

d. Ventilation Equipment

- i. Pump stations shall be adequately vented in accordance with 15A NCAC 02T. .0350(h)(3) as well as in complete compliance with all applicable local and state building codes as well as OSHA and NFPA standards.
- ii. At a minimum, pump station wet wells shall be provided with a gooseneck-type vent. Active ventilation units shall also be acceptable.
  - 1. Vents shall be constructed of sturdy material that is resistant to ultraviolet light and adequately supported to withstand damage during normal and emergency operation and maintenance.
  - 2. Vent elevations shall be a minimum of two (2) feet above the 100-year flood elevation as identified on the most recent FEMA map when available or as established through appropriate modeling techniques.
  - 3. Vents shall be provided with an insect/bird screen of stainless steel, aluminum, corrosion-resistant material. Under no circumstances shall steel or galvanized steel be used.
- iii. Dry wells or other enclosed pump station structures into which routine operator entry is required shall either have a positive-pressure ventilation system that meets, at a minimum, the requirements of NFPA 820 "Standard for Fire Protection in Wastewater Treatment and Collection Facilities." Consideration shall be given to installing sensor and alarm systems to detect the accumulation of dangerous levels of hazardous gases.

e. Other Equipment

- i. Consideration shall be given to controlling the pump station temperature and

humidity to a level appropriate for reliable operation of the electrical and instrumentation/control systems.

- ii. Pump station structures other than the wet well shall be provided with a means to remove accumulated water and wastewater from the structure. All floor and walkway surfaces shall be sloped such that water and wastewater drains to the removal area under the influence of gravity. "Acceptable removal means" includes the following:
  - 1. An appropriately sized drainage pipe.
    - (i) The drainage pipe shall convey accumulated water and wastewater to the wet well or other available entry point into the wastewater collection system. Under no circumstances shall the drainage pipe convey accumulated water and wastewater to daylight, into surface water, or into the ground.
    - (ii) The discharge of the drainage pipe shall be higher than the high-water alarm activation level in the wet well or the maximum water level expected at the other available entry point into the wastewater collection system.
    - (iii) The drainage pipe shall be provided with a device to prevent backflow of wastewater and gases from the wet well into the structure.

n. Electrical and Instrumentation/Control Systems Design

i. General Requirements

- a. Electrical systems for pump stations shall be designed and installed in strict conformance with NFPA 70 "National Electric Code," ANSI, as well as all applicable federal, state, and local codes.
  - i. In general, electrical and instrumentation/control systems and components shall be protected against corrosive conditions.
  - ii. If located in a wet well or other location where explosive or flammable gases may concentrate, electrical and instrumentation/control systems and components shall meet the requirements for a Class I, Group D, Division 1 location.
- b. Each pump and motor unit shall be provided with a separate electrical supply, motor starter, alarm sensors, and electrical and instrumentation/control systems and components.
  - i. Electrical and instrumentation/control systems and components shall be located such that they may be disconnected from outside a wet well.
  - ii. Cables and conduits shall be provided with seals that are both watertight and gas

tight, shall be protected from corrosion, and shall allow separate strain relief.

- c. The main power feed to all pump stations shall be equipped with an above-grade, fused disconnect switch.

- ii. Enclosures

- a. Enclosures for electrical and control components for the pump station shall be located outside of the wet well and in a location such that they are readily accessible, ensure maximum electrical and personnel safety, and are protected from damage due to vehicular traffic and flooding.
- b. Enclosures shall have a NEMA-rating that is appropriate for the installation location at the pump station.
  - i. If not housed, enclosures shall have a minimum stainless steel NEMA 4X rating. Stainless steel NEMA 4X enclosures shall be used in locations where the potential for flooding and the development and accumulation of corrosive gases exists. NEMA 4X stainless steel enclosures shall be used for all outdoor installations.
  - ii. Enclosures shall be protected by a conduit seal or other appropriate sealing method that meets the requirements of NFPA 70 to protect the wet well atmosphere from gaining access to the enclosure. This seal shall be located such that it will not be disturbed during routine operation and maintenance functions at the wet well for a Class I, Division 2 location.

All enclosures and all switches and indicator lights, whether mounted on an inner door or face of the enclosure, shall be provided with a label that conforms to UL descriptions and procedures.

- c. All interior components shall be mounted on a stainless steel backboard.
- d. The Applicant's lock-out/tag-out procedures shall be considered in the design of all enclosures to be installed at the pump station.

- iii. Instrumentation and Controls

- a. Wastewater Level Sensing Equipment

- i. Pump station cycles, as described in Section 2.04A.2., shall be controlled by wastewater level sensing equipment in the wet well.
- ii. At a minimum, wastewater levels within the wet well shall be detected by Anchor Scientific Mini Floats. If an alternate method of level detection, including but limited to bubble tube, and/or ultrasonic meter, is used, a float switch at the high-water alarm level shall be installed as a back-up, all of which is subject to acceptance by PLURIS.

- iii. Wastewater level sensing equipment shall be used to indicate the following levels and operate the pump station correspondingly: all pumps off, lead pump on, lag pump on, and high-water alarm.
- iv. Wastewater level sensing equipment shall be located so as not to be affected by flows entering the wet well or the turbulence created by the suction of the pump.

b. Components

- i. The pump station shall be equipped with sufficient instrumentation/control systems and components to monitor and control key operating conditions.
- ii. At a minimum, the following systems and components shall be provided for the pump station:

1. Pump Station Function

- (i) Each pump installed at the pump station shall be provided with a "hand-off-auto" selector switch so that the operational mode of the pump may be selected.
- (ii) Each pump installed at the pump station shall have a pump run timer that can keep a cumulative log of the operational time of each pump.

2. Sufficient indicator lights shall be used to demonstrate the operational status of the pump station. The indication lights shall be specific to the condition detected. At a minimum, indicator lights shall be provided for each pump to indicate a "pump on" condition and a pump alarm/failure condition.

3. Weather-proof audible and visual alarms that are external to any structure or enclosure shall be provided at the pump station in accordance with 15A NCAC 2H .0219(h)(5). In the event of a power loss at the pump station or a failure of the automatically activated stand-by emergency source, the alarm system shall be operated from a battery back-up power source. This battery back-up power source shall be provided with continuous charge. At a minimum, the following conditions shall be monitored by the system, and each shall cause activation of the audible and visual alarms:

- (i) Pump failure.
- (ii) Wastewater level sensing failure (if applicable).
- (iii) High-water level in the wet well.
- (iv) High-water level in the dry well sump (if applicable).

(v) Loss of telemetry transmission line (if applicable).

- (vi) Loss of power supply.
  - (vii) Automatically activated stand-by power generation source failure (if applicable).
4. A telemetry system shall be installed at all pump stations regardless of the reliability method employed in the pump station design.
- (i) The telemetry system shall contact personnel capable of initiating a response to a pump station alarm condition 24 hours per day, 365 days per year.
  - (ii) In the event of a power supply loss at the pump station or a failure of the automatically activated stand-by emergency source, the telemetry system shall be operated from a battery back-up power source. This battery back-up power source shall be provided with continuous charge.
  - (iii) The telemetry system shall be activated for any of the following alarm conditions: high water in the wet well, pump failure, loss of power supply, and automatically activated stand-by emergency source failure (if applicable).

#### 5. Appurtenances

- (i) Sufficient 110-volt electrical receptacles shall be provided to facilitate maintenance at the pump station. If located in an outdoor area, the receptacles shall be of the ground fault interruptible type and shall be protected from the weather elements.
- (ii) If reliability for the pump station is based on a contingency plan that involves portable bypass pumping units, the pump station shall be provided with a suction and discharge quick connection plumbing port for a mobile bypass pump.

#### iv. Reliability

- a. Pump station reliability shall be in accordance with 15A NCAC 02T .0350(h)(1) and shall be considered a key, integral part of the overall pump station design.
- b. The following reliability infrastructure shall be incorporated into the pump station design:
  - i. The pump station shall be connected to an automatically activated stand-by bypass pumping system. The pumping system will operate independently from the pump

station submersible pumps and be activated by an independent level sensor/float system.

1. The permanently installed emergency back-up pump set specified in this section will be used to pump wastewater and raw sewage in applications requiring a suction lift or as an inline booster pump.
2. The pump and accessories shall be supplied by the pump manufacturer.
3. The pump shall be fitted with a fully automatic priming system incorporating an air compressor, air ejector assembly, and an air/water separation tank. The priming system shall be capable of priming the pump from a completely dry pump casing. The air ejector shall operate on the discharge side of the compressor, eliminating the possibility of water being drawn into the air source. The pump must be capable of running totally dry for periods up to twenty-four (24) hours, then automatically repriming and returning to normal pumping volumes without need for any adjustment.
4. The priming system shall not use a vacuum or diaphragm pump, nor require the use of a "foot"-type valve. It shall contain no moving parts or protective float gear. Priming systems that require manual water additions to facilitate pump priming are not acceptable. A demonstration of the pump's ability to repeatedly cycle from dry suction/pump/snore/repriming/pump shall be required. This will necessitate the draining of all residual water from the pump case to initiate a dry suction starting condition.
5. Pump and priming system shall be fully automatic, needing no form of adjustment or manual addition of water for the priming system. The pump shall be capable of static suction lifts to twenty-eight (28) vertical feet, at sea level. It shall also be capable of operation using extended suction lines.
6. Equipment acceptance shall be contingent upon the pump's ability to run continuously at full speed in a completely dry condition for periods up to twenty-four (24) hours. This may require the draining of all residual water in the pump casing to simulate a dry suction/case condition. The Developer's Engineer of Record may require a demonstration.
7. The engine and pump shall be completely enclosed with fourteen-gauge sheet metal panels backed with one-inch and two-inch layers of poly damp acoustical sound-deadening material. The acoustical enclosure shall reduce pump and engine noise to sixty-eight (68) dBA or less at thirty (30) feet. The enclosure shall be removable for easy access to the engine/pump for maintenance and repair. The enclosure doors shall all be equipped with latches that are keyed alike. For maintenance and service needs, the enclosure sides shall have hinged doors for quick access to the engine oil fill, fuel fill port, oil dipstick, and filters.
8. A complete submittal of the bypass pumping system shall be submitted to PLURIS for review. This submittal shall include all engineering calculations for

the system. PLURIS may be contacted prior to bypass system design for additional specifications and acceptable system manufacturers.

9. The suction piping shall be a minimum of 4-inch stainless steel when located in the wet well, 4-inch DIP when located in the valve vault or above ground. Above ground stubs for a mobile pumping unit shall extend a minimum of twenty-four (24) inches with a maximum of thirty-six (36) inches above the adjacent finished grade. The stubs are to have four (4) Bauer connections on both the suction and discharge. The discharge line should be plumbed to the discharge line in the valve vault with a 4-inch weighted swing arm check valve.
10. For lift stations that do not meet the standard NCDEQ requirement for permanent reliability systems, the station shall be plumbed to accept a portable bypass pump. The suction piping shall be a minimum of 4-inch stainless steel when located in the wet well and 4-inch ductile iron DIP when located in the valve vault or above ground. Above ground stubs for a mobile pumping unit shall extend a minimum of twenty-four (24) inches with a maximum of thirty-six (36) inches above the adjacent finished grade. The stubs are to have 4-inch Bauer connections on both the suction and discharge. The discharge line should be plumbed to the discharge line in the valve vault with a 4-inch weighted swing arm check valve.

o. Operations and Maintenance (O&M) Manuals

- i. An O&M Manual shall be prepared for each pump station and shall be made available to the applicant upon start-up of the pump station/force main system.
- ii. A copy of the O&M Manual shall be kept at the Applicant's central office. The O&M Manual shall be kept on file for the life of the pump station and updated as required.
- iii. At a minimum, O&M Manuals shall contain the following minimum information:
  - a. Approved shop drawings, including design data for all installed equipment and each major component and a pump curve/system curve analysis showing the design operating point(s).
  - b. Control panel wiring diagrams.
  - c. Warranty information for all installed equipment and each major component.
  - d. Inventory, functional descriptions, and complete operating instructions for all installed equipment and each major component.
  - e. Instructions for start-up/shutdown, as well as for calibration and adjustment of all installed equipment and each major component.
  - f. Recommended maintenance management system, including preventative and predictive maintenance, for all installed equipment and each major component.

- g. Contingency plan and analysis of critical safety issues.

- h. Contact information for local service companies, as well as instructions for replacement of all installed equipment and each major component.
- i. Contact information for local contractors capable of performing emergency repairs.
- j. Contact information for regulatory and other agencies.

### 3. Testing

- a. Operational Test - Before the operational test is conducted, the required copies of the Operation and Maintenance Manuals shall be delivered to PLURIS, and the wet well shall be thoroughly cleaned to remove dirt, mud, gravel, and other foreign debris. The operational test shall check the proper functioning of the pumps and pump controls. The pump, motor and related components' serial numbers shall be verified. All components of the pump station shall be checked to ensure that they can perform the service intended. The operational test shall be performed by PLURIS. The Contractor or Developer shall ensure that a representative from the pump station equipment manufacturer is present at the operational test to review proper operation of the equipment with PLURIS personnel.
- b. Contractor's Responsibility - The Contractor shall furnish all materials, labor, and equipment to perform all testing, including water.
- c. Watertightness Testing (Pump Station Testing)
  - i. Wet wells and other wastewater-containing structures at the pump station shall be inspected and evaluated for watertightness.
  - ii. The watertightness test for the wet well and other wastewater-containing structures at the pump station shall be completed separately and independently of the leakage test performed on the force main as required in Section 6.04D of the NCDEQ Minimum Design Criteria.
  - iii. The watertightness test shall be performed in the presence of the applicant, the PE, or other authorized representative.
  - iv. The watertightness test shall be performed in accordance with ACI 350.1R "Testing Reinforced Concrete Structures for Watertightness," AWWA D100 "Welded Steel Tanks for Water Storage," or the manufacturer's recommendations. A vacuum test method in accordance with ASTM C1244 "Standard Test Method for Concrete Sewer Manholes by Negative Test Pressure (Vacuum) Test" may be used for small diameter wet wells in lieu of a hydraulic test.
    - a. Unless the pump station wet well is constructed of cast-in-place concrete, testing shall not commence until the structure being tested has been fully assembled and backfilling is complete.

- b. All inlets and outlets in the structure shall be temporarily plugged and braced or otherwise sealed prior to initiating the test.

- c. Pump station wet wells that fail to meet the watertightness test requirements shall be inspected, made watertight, and retested until the test passage is assured.
- d. Pump Testing
  - i. Factory Testing
    - a. All pumps shall be tested by the manufacturer in accordance with the appropriate UL standard prior to shipment for installation.
    - b. The results of all factory testing shall be maintained by the applicant as part of the construction record documentation as stipulated in NC DENR's "Minimum Design Criteria for the Fast-Track Permitting of Pump Stations and Force Mains" Section 1.03B.
  - ii. Drawdown Testing
    - a. Following installation, each pump in the pump station shall be subjected to a drawdown test or other similar testing procedure to confirm that the pump is operating at or near the required design operating point(s).
    - b. The drawdown test shall be performed in the presence of the applicant, the PE, or other authorized representative and a PLURIS representative.
    - c. The results of all drawdown testing shall be maintained by the applicant as part of the construction record documentation as stipulated in NC DENR's "Minimum Design Criteria for the Fast-Track Permitting of Pump Stations and Force Mains" Section 1.03B.
  - iii. Witnessed Testing
    - a. Consideration shall be given by the applicant to require a witnessed test for large pumps, pumps in critical installations, or pump replacement/repair situations.
    - b. All witnessed testing shall be performed in accordance with the appropriate HI standard.
    - c. Witnessed testing shall be performed in the presence of the Applicant, the Engineer of Record, or another authorized representative.
    - d. The results of all witnessed testing shall be maintained by the applicant as part of the construction record documentation as stipulated in NC DENR's "Minimum Design Criteria for the Fast-Track Permitting of Pump Stations and Force Mains" Section 1.03B.

e. Electrical and Instrumentation/Control System Testing

- i. The Applicant shall ensure that a formal testing program of all electrical as well as instrumentation and control systems installed at the pump station is developed and performed.
- ii. The program may consist of a combination of unwitnessed/witnessed factory tests, field readiness tests, and witnessed field tests. At a minimum, however, the Applicant shall witness a field test of the pump station's electrical and instrumentation/control systems. The basic functions that shall be tested for operation as intended by the pump station design shall include, but not be limited to, the following:
  - a. Pump operational functions.
  - b. Level-sensing equipment.
  - c. Alarm system.
  - d. Telemetry system.
  - e. Emergency Bypass Pump system.
- iii. All testing of the electrical and instrumentation/control systems shall be performed in the presence of the Applicant, the PE, or other authorized representative.
- iv. The results of all testing shall be maintained by the applicant as part of the construction record documentation as stipulated in NC DENR's "Minimum Design Criteria for the Fast-Track Permitting of Pump Stations and Force Mains" Section 1.03B.

#### 4. Electrical

- a. General - Electrical service to all pump stations shall be three (3) phase, 240 or 460 V AC with a wye connection. The electrical power entrance shall be through a meter base, followed by a NEMA 4X heavy duty, single throw, fusible safety switch with a solid neutral; followed by a NEMA 4X heavy duty, double throw, three (3) pole safety switch which feeds the control panel from one side and heavy duty, circuit breaking four (4) wires, four (4) pole receptacle assembly as manufactured by Crouse-Hinds or other equivalent receptacle to Crouse-Hinds approved by PLURIS from the other side. All these electrical components shall be suitably sized to be capable of service with both sewage pumps running.

All electrical components, including panel, shall be sealed off with duct seal type sealant in accordance with the N. C. Electrical Code requirements for electrical service to gas pumps.

b. Control Equipment Enclosure

- i. NEMA4X Enclosure - Enclosure shall be a NEMA type 4X and be of suitable size to house all components. A locking hasp shall be provided in addition to screw clamp type latches. Enclosure shall be fabricated from 14-gauge steel. The top of the enclosure shall serve as a drip shield, and the seam free sides shall prevent rain and sleet from entering. The inner panel shall be made of 12-gauge steel and shall be painted white. The enclosure and interior panel shall be painted with heat-fused, modified polyester powder, electrostatically applied over a phosphatized base. Enclosure shall be ANSI/ASI 61 grey.
- ii. Hinged Inner Door - An inner door shall be furnished. Overload reset push buttons, circuit breakers, switches, and pilot lights shall be the only components accessible with door closed. The door shall be hinged and may be opened when service is required.
- iii. Line Terminal Block - A terminal block shall be furnished with properly sized line lugs to accept the main power source entering the control panel. Load lugs shall be adequate to accept all required load side wiring requirements. All live parts shall be fully shielded.
- iv. Motor Circuit Breakers (240 V AC) - A properly sized, molded case, thermal magnetic circuit breaker shall be provided for each pump motor. Line and load sides shall be equipped with lugs properly sized for the horsepower and current rating of the motor(s). They shall be attached to mounting brackets that are specifically manufactured for use with the circuit breaker. The interrupting rating shall be 10,000 RMS symmetrical amps.
- v. Transformer Primary Circuit Breaker (when transformer is required) - A properly sized, two pole, molded case circuit breaker shall be furnished ahead of the control power 120 V AC power transformer for short circuit protection and disconnecting power to the transformer. The circuit breaker shall conform to the specifications for the motor circuit breaker(s).
- vi. Control Power Transformer (when neutral is not available at jobsite - Std. on 460 V AC) - An industrial quality control transformer shall be furnished to provide control voltage. The transformer shall be sized with an adequate KVA rating to provide 120 V AC power for all items required in the control and alarm circuits. The transformer shall be protected in its secondary by properly sized fuses and/or circuit breaker(s).
- vii. Magnetic Contactor and Overload Relays - A magnetic contactor shall be furnished for each motor. A separate, panel-mounted, 3-leg (three phase) or 1-leg (single phase) overload relay shall be supplied for each motor. Each leg of the overload relay shall be equipped with a properly sized overload heater. Contactor and overload relay shall be properly sized for the required horsepower, voltage, and phase.
- viii. Elapsed Time Meters - Six-digit, non-resettable elapsed time meters shall be mounted in the control panel enclosure to record the running time of each pump.
- ix. Condensation Strip Heater with Thermostat - A strip heater shall be furnished to prevent

condensation within the control panel enclosure. The heater shall be controlled by a panel mounted, adjustable thermostat.

- x. Phase and Voltage Monitor - A phase failure, reversal, and under voltage monitor shall be supplied to prevent the motors from running under low voltage, phase loss, or phase reversal conditions. The monitor will lock out the control circuit until the problem is corrected and automatically reset.
- xi. Lightning Arrestor - Suitable lightning arrestors shall be provided to protect motors and control equipment from lightning-induced line surges.
- xii. Thru-Door Overload Reset Push Buttons - Overload reset push buttons shall be provided for each overload relay. Push buttons shall be mounted so that with the inner door closed, overload relays may be reset without entering a high-voltage compartment.
- xiii. Switches - Heavy duty industrial grade oiltight switches shall be provided for each pump for "Hands-Off-Automatic" operation selection. All switch components shall be made of corrosion resistant metals and polyesters. Contact blocks shall be made of see-through polycarbonate for simplified inspection of contacts. Cams and strokes shall be Teflon impregnated for abrasion free service without lubrication. The switches required shall be as follows:

Switch Function (Name Plate)	Voltage
Manual-off-Automatic	120 V AC

- xiv. Pilot Lights - Full voltage heavy duty industrial grade oiltight pilot lights shall be provided. All pilot light components shall be made of corrosion-resistant metals and polyesters. An insulated socket shall be furnished to eliminate the possibility of shock during bulb change. Lens shall be made of Lexan. The pilot lights required shall be as follows:

Pilot Light Function (Name Plate)	Voltage	Lens Color
PUMP 1	120 V AC	GREEN
PUMP 2	120 V AC	GREEN

- xv. Seal Failure Circuit Test Push Button (illuminated) - Heavy duty, industrial grade, oiltight push buttons shall be provided for each submersible pump motor. All push button components shall be made of corrosion-resistant metals and polyesters. Contact blocks shall be made of see-through polycarbonate for simplified inspection of contacts. An insulated socket shall be furnished to eliminate the possibility of shock during bulb change. Lens shall be made of Lexan. The push buttons required shall be as follows:

Pilot Light Function (Name Plate)	Voltage	Lens Color
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P1 SEAL FAIL	120 V AC	AMBER
P2 SEAL FAIL	120 V AC	AMBER

- xvi. Pump Alternator Circuit (For Duplex Pump Operation) - The electromechanical alternator relay shall be of industrial design specifically for use in pump applications. It shall have single pole, double throw, heavy duty, 10-amp, silver cadmium, oxide contacts enclosed in a transparent cover. The snail action contacts shall transfer when the unit is deenergized. The circuit shall never be closed or opened while current is being conducted. The alternator circuit shall alternate the lead pump position between the pumps and shall allow the lag pump to start in response to a rising water level in the wet well. (P1 – ALT – P2 selector switch).
- xvii. Power Failure - Once power is restored after a failure and the pump has pumped the water from alarm level down to pump off, the alarm should automatically reset.
- xviii. Control Relay(s) - Plug-in control relays with 120 V AC coils shall be provided as required. Contact rating shall be five (5) amps (minimum). Sockets shall be from the same manufacturer as the relays, and hold-down clips shall be furnished to prevent relay from sliding out of the socket.
- xix. High Wet Well Level Alarm - The control panel shall be provided with a suitable alarm circuit, activated by a separate level control. This alarm shall signal a high-water condition in the sump. Terminals shall be furnished in the control panel for connection of an externally mounted alarm device. A red flashing light shall be provided as a visual alarm and a horn provided as an audible alarm of the high-water condition in the wet well. The pump station shall also be equipped with buttons to both test and silence the horn.

## **Part VIII Simplex Stations**

### **1. PLURIS Policy on Allowing Simplex Stations**

It is the intention of PLURIS to limit the addition of new simplex pump stations to the current collection system. New simplex pump stations will be allowed only under the following conditions:

- a. Service areas with gravity collection systems will require a gravity service for residences. In the case where a gravity service is not practical due to low lot elevations, a simplex station may be allowed on a case-by-case basis. These situations will allow for a simplex station to pump to a gravity line only. In this situation the pump station is the sole jurisdiction of the NC Plumbing Code and will not be incorporated into the collection system.

Large numbers of simplex stations pumping to gravity collection lines will not be allowed in new developments and will in no way account for more than 5% of the total services for any development.

- b. In areas where force mains are installed and no gravity line is within reasonable distance, simplex pump stations will be allowed by PLURIS approval on a case-by-case basis. PLURIS reserves the right to require any developer or applicant to install gravity collection lines and standard duplex pump stations as outlined in Part VII of these specifications. Multiple homes, multifamily structures, and areas of new development will not be permitted to install simplex pump stations in lieu of conventional gravity collection systems.
- c. Simplex pump stations will be permitted for single family home sites only. The use of simplex pump stations for commercial use shall not be permitted unless the following conditions apply:
  - i. The projected average daily flow for the facility is less than the current single-family equivalent for a three-bedroom residence in the same area. This includes areas that have been granted flow reductions. In no way shall a commercial service be allowed to use a simplex pump station that exceeds the average daily flow of 360 gallons per day. The applicant must provide flow calculations signed and sealed by a NC Professional Engineer outlining the average daily flow for the facilities. These calculations shall reflect the standard rates of discharge allowed for such facilities by NCDEQ regulation., specifically 15A NCAC 02T .0305 and all applicable design criteria and future revisions of this rule.
  - ii. The applicant will obtain a variance for the use of a simplex pump station from the NCDEQ.
  - iii. The applicant will provide all required permits and design documents for the pump station. All required permitting, design fees, permit fees, material costs, installation costs, and any other applicable costs will be the responsibility of the Applicant.
- d. All costs associated with the installation of a simplex pump station will be the responsibility of the Applicant. This includes but is not limited to the cost of any required permits or variances, design fees, material costs, installation costs, testing and inspection costs or any other applicable fees.
- e. If required by NCDEQ the Applicant will furnish, at its expense, a hydraulic model of the proposed simplex station and its effect on the collection system. This model will be used to determine required head pressures, pump size, and other design criteria. This model data will be provided to PLURIS for review and will become the intellectual property of PLURIS.
- f. If required by NCDEQ, the Applicant will apply for a variance for a simplex pump station based on the rules and requirements of NCDEQ, specifically the August 2008 "Draft Alternative Design Criteria for Minimum Separation for Sewer Systems to Wetlands" 15A NCAC 2T .0305(f) and the "Policy for Meeting the Reliability Requirements" of 15a NCAC 2T .305(h)(1)(D) for pressure sewers utilizing simplex pump stations.
- g. The electrical service and power consumption for all simplex stations will be the responsibility of the Applicant. This responsibility will transfer to any person or entity that purchases any real estate served by a simplex pump station.

## 2. Simplex Pump Station Design

- a. Siting – All simplex pump stations will be sited on the Applicant's private property and not located in a public right of way. The location of all simplex pump station connections to the force main will be approved by PLURIS. The simplex pump station will be in a recorded utility easement in an area that provides the shortest distance from the pump station to the connection point in the collection system. All applicable separations as stated in NCAC 2T .0305 will be met for installations that are unable to meet the required separations, the Applicant may apply for a variance from NCDEQ.

Care will be taken not to locate the pump station in excessive vegetation or landscape position that hinders maintenance of the station.

- b. Approved manufacturers – All simplex stations will be manufactured for use as a package system complete with all required valves, piping, level control devices, wet wells, control panels and all other appurtenances required. Simplex pump stations will be manufactured by Meyers or another approved manufacturer. The applicant will furnish all specifications, shop drawings, cut sheets, and other applicable information to PLURIS prior to approval for installation and connection to the collection system.
- c. Materials – All materials used in the simplex pump station will correspond to industry standards for use with sanitary sewage. All materials shall be non-corrosive, such as stainless steel, aluminum, plastic, fiberglass, or composite whenever practical. PLURIS reserves the right to deny the installation of any package system that uses substandard corrosive materials.
- d. Wet Well Storage
  - i. The wet well of a simplex pump station will meet the "Policy for Meeting the Reliability Requirements" of 15a NCAC 2T .305(h)(1)(D) for pressure sewers utilizing simplex pump stations. The requirements for storage are as follows:
    - 1. The first option for meeting reliability requirements is to provide 24-hour storage in the wet well above the pump-on elevation as requested in the permit application. However, since this may add to the cost and make installation difficult in certain areas, another option may be pursued.

Alternatively, the applicant may provide documentation regarding both power reliability and response times for pump replacement.
    - a. In the case of power reliability, 3 years of power history data in the area from the power company must be provided. The amount of storage required shall be equal to the duration of the longest power outage (minus catastrophic events such as hurricanes). Storage shall be provided above the pump-on elevation.

- b. For response times, the applicant shall provide an estimate of the response time to replace a failed pump. The estimate shall include time for answering after-hours calls, travel time to maintenance shop, preparing equipment to respond, travel time to site, and time to replace the pump. For existing systems, the Permittee should indicate whether they currently maintain a supply of pumps on hand at the time (a permit condition). Also, personnel must be on call 24 hours a day, 7 days a week, as well as provide a phone number with 24-hour answering service clearly posted on the pump station. Storage shall be provided above the high-water alarm.
  2. A minimum of 120 gallons of storage above alarm shall be included in the evaluation.
  3. These storage requirements are not cumulative; rather, the storage that provides the largest wet well shall be specified.
  4. Storage in the service line to the pump station will not be included in these calculations.
- ii. All wet wells shall be installed a minimum of two (2) feet above the 100-year flood elevation unless a variance is granted by NCDEQ.
- e. Pump Sizing – Simplex pumps will be sized based upon a hydraulic model of the collection system and the anticipated head pressure at the force main connection point. At no time will the pump size be less than two (2) HP. Where a hydraulic model of the system is not required by NCDEQ, the default pump size will be a two (2) HP grinder pump. The pumps shall be a Meyers WGL20-21 2 HP capable of pumping 20 gallons per minute at 56 feet of total dynamic head or equal.
- f. Control Panel – The control panel shall be a single phase 230-volt simplex panel with visual and audible alarms. The enclosure shall be a NEMA-4X rated enclosure with a gasketed door. The control circuit shall be single phase 120 volts. The control panel shall meet or exceed the specifications of the pump manufacturer and have the following:
  - i. A hand-off, automatic control switch
  - ii. Cycle counters and elapsed time meters
  - iii. Audible alarm and visual alarm
  - iv. The control panel shall meet all NC building codes and NEC codes, and the power to the panel shall be installed by a licensed electrician.
  - v. All control panels shall be installed a minimum of twelve (12) inches above the 100-year flood elevation unless a variance is granted by NCDEQ.
- g. Venting – The wet well shall be vented above the 100-year flood elevation, and the vent shall have a no corrosive insect screen installed.

- h. Anti flotation – The Applicant will demonstrate through signed and sealed engineering calculations a method of restraining the wet well from flotation during flood events or high ground water. Typical restraints shall include a concrete lug poured around an extended lip manufactured into the wet well.

### 3. Testing

- a. All simplex pump stations and associated force mains will be tested for operation and leakage. All control mechanisms, alarms, and control panel functions will be verified.
- b. In cases where the system was designed by a NC Professional Engineer and permitted through NCDEQ, the Engineer's and Owner's certifications will be provided to PLURIS prior to the system being activated.

**SECTION 33 40 00  
SITE STORM DRAINAGE UTILITIES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes site drainage systems outside the building. Systems include the following:
  - 1. Storm drainage.
  - 2. Foundation drainage connections outside of building.
  - 3. Roof drainage connections outside of building.
- B. Related Sections: The following Sections contain requirements that relate to this Section.
  - 1. Division 31 Section "Earth Moving."
  - 2. Division 31 Section "Sediment and Erosion Controls."
  - 3. Division 3 Section "Cast-In-Place Concrete."
  - 4. Division 22 Sections for storm drainage inside the building.

**1.3 DEFINITIONS**

- A. Drainage Piping: System of pipe, fittings, and appurtenances for gravity flow of storm drainage.

**1.4 SUBMITTALS**

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. As-Built Survey / Record drawings of installed drainage system piping and basins and all stormwater management devices (ponds, wetlands, bio-retention areas). Survey shall be submitted as soon as possible and at least 30-days prior to the project's substantial completion and prior to plant installation in wetlands and other similar devices.

**1.5 QUALITY ASSURANCE**

- A. Environmental Agency Compliance: Comply with regulations pertaining to storm drainage systems.
- B. Utility Compliance: Comply with regulations pertaining to storm drainage systems.
- C. Product Options: Drawings indicate sizes, profiles, connections, and dimensional requirements of system components and are based on specific manufacturer types indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Products."
- D. All work within any NCDOT right-of-way shall conform to the requirements of the current version of the NCDOT's Policies and Procedures for Accommodating Utilities on Highway Rights of Way, the provisions and conditions of the encroachment agreement(s), and other applicable NCDOT standards and policies. The encroachment agreement(s) are considered part of the project specifications by reference. Copies of the agreement(s) will be provided upon request from the Architect.
- E. Perform As-Built Survey of installed drainage system piping and basins and all stormwater management devices (ponds, wetlands, bio-retention areas). As-built survey shall be signed and seal by a NC Professional Land Surveyor and shall include the following:
  - 1. All inlet, junction box and manhole locations with no less than two primary reference dimensions from permanent above grade features.
  - 2. As-built rims and inverts noted.
  - 3. Pipe materials and sizes, plus slopes and distances between structures.

4. As-built dimensions for installed riprap dissipater pads.
5. Topography of embankments and interiors of drained stormwater management ponds, wetlands and bio-retention cells. Topography shall include all survey point elevations.
6. Detailed as-built dimensions and elevations of stormwater management device outlet structures, weirs, orifices, and outlet pipes.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic structures in direct sunlight.
- B. Do not store plastic pipe or fittings in direct sunlight.
- C. Protect pipe, pipe fittings, and seals from dirt and damage.

#### 1.7 PROJECT CONDITIONS

- A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.
- B. Locate existing structures and piping to be closed and abandoned.
- C. Field verify locations and elevations of existing storm drainage infrastructure at locations of connection to new work prior to beginning storm drainage installation. Notify Architect if discrepancies are discovered that required design modifications.
- D. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or 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.

#### 1.8 SEQUENCING AND SCHEDULING

- A. Coordinate storm drainage system connections to utility company's storm sewer.
- B. Coordinate storm drainage system connections to existing on-site storm sewer.
- C. Coordinate with interior building drainage systems.
- D. Coordinate with other utility work.

### PART 2 - PRODUCTS

#### 2.1 PIPES AND FITTINGS

- A. General: Refer to plans for specific pipe material applications.
- B. Ductile-Iron Pipe: ANSI/AWWA C150/A21.50 and C151/A21.51, minimum pressure class 250.
  1. Lining: AWWA C104, cement mortar, coal tar epoxy lined.
  2. Gaskets, Glands, and Bolts and Nuts: AWWA C111.
  3. Push-On-Joint-Type Pipe: AWWA C111, rubber gaskets.
  4. Coating: AWWA C151, bituminous coating.
- C. Polyvinyl Chloride (PVC) Sewer Pipe and Fittings: ASTM D-1785, SCH 40 PVC for solvent-cemented or gasketed joints.
  1. Primer: ASTM F 656.
  2. Solvent Cement: ASTM D 2564.
  3. Gaskets: ASTM F 477, elastomeric seal.
- D. Reinforced-Concrete Sewer Pipe and Flared End Sections: ASTM C 76, Class III. Provide Class IV where noted on the drawings.

1. Standard Joints: Plastic cement putty seal meeting ASTM C990 and Federal Specification SS-S-00210.

## 2.2 STORM SUB-DRAIN AND FOUNDATION DRAIN PIPING

- A. Storm Sub-Drain Pipe and Fittings: SCH 40 PVC or dual-wall, smooth interior HDPE, with ½-in drilled perforations. Minimum 4-inch diameter unless otherwise indicated on the drawings. Non perforated pipe shall be used outside of area to be drained to connect sub-drains to drainage inlets.
- B. Filter Fabric: Woven geotextile Drainage (Filter) Fabric as specified in Division 31 Section "Earth Moving."

## 2.3 SPECIAL PIPE COUPLINGS AND FITTINGS

- A. Connection from roof downspout to underground storm pipe.
  1. Vertical stainless-steel downspout adapter with sch. 40 PVC pipe outlet sized to fit over downspout and underground piping. Adapter shall have a self-cleaning debris trap consisting of a hinged cover and removable debris screen. Powder-coat color to be selected by Architect from manufacturer's full range of colors. As manufactured by Piedmont Pipe Construction.
  2. Manufactured fitting of material similar to downspout sized to connect to standard round pipe shape of underground piping.

## 2.4 DROP INLETS AND CATCH BASINS

- A. General: Brick and mortar or precast concrete, of depth, shape, and dimensions indicated. Knock-out "waffle" boxes shall not be used. All structures shall be designed to withstand AASHTO HS-20 loads and meet NCDOT standards.
- B. Brick Inlets: Brick and mortar or precast concrete, of depth, shape, and dimensions indicated.
  1. Base, Channel, and Bench: Concrete.
  2. Wall: ASTM C 32, Grade MS, clay brick masonry units.
    - a. Option: ASTM C 55, Grade S-II, solid concrete brick masonry units may be used instead of clay brick.
  3. Mortar: ASTM C 270, Type S, using ASTM C 150, Type I, portland cement.
- C. Precast Concrete Inlets: ASTM C913, precast, reinforced concrete, of depth, shape, and dimensions indicated designed for HS-20 loading. Precast boxes shall include grade rings to allow adjustment to rim elevations. Knock-out waffle boxes shall not be used.
  1. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
  2. Riser Sections: 4-inch minimum thickness and lengths to provide depth indicated.
  3. Top Section: Flat-slab-top type is indicated.
  4. Joint Sealant: ASTM C990, bitumen or butyl rubber.
  5. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
  6. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness to allow field adjustment of rim elevation.
- D. Steps: Individual FRP steps or deformed, 1/2-inch steel reinforcing rods encased in polypropylene plastic, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 42 inches.
- E. Pipe Connectors: ASTM C923, resilient, of size required, for each pipe connecting to base section.
- F. Frames and Grates: ASTM A48, Class 35B, cast iron, H-20 loading. Include flat grate with small square or short-slotted drainage openings as indicated on the drawings.

1. Provide drop inlet grates with openings compliant with ADA standards when located within sidewalk or other pedestrian walking areas and/or where specifically indicated on drawings.
- G. Catch Basin Hood Casting: ASTM A48, Class 35B, cast iron, H-20 loading.
- 2.5 AREA, IN-LINE, BASIN AND FLOOR DRAINS
- A. Floor Drains: 12-inch diameter or 12-inch square top drain, Dura-Coated cast iron body with 6-inch bottom outlet, seepage pan, adjustable extension frame and medium duty slotted grate. Top shall be polished nickel bronze and secured with slotted screws.
  - B. Area Drains or Planter Drains: 15-inch square top drain designed to be attached with a watertight connection to vertical HDPE or PVC pipe, ductile iron slotted surface grate, watertight pipe adapters. Grates shall be pedestrian-type where set in pavement or sidewalk. Grates shall be dome-type where set in mulched areas.
  - C. In-Line Drains: 12-inch ductile iron drain designed to be attached with a watertight connection to vertical HDPE or PVC pipe, slotted surface grate of shape indicated on the drawings, watertight pipe adapters. Grates shall be pedestrian-type where set in pavement or sidewalk. Grates shall be dome-type where set in mulched areas.
- 2.6 MANHOLES
- A. Precast Concrete Storm Drainage Manholes: ASTM C-478 precast reinforced concrete, eccentric cone. All structures shall be designed to withstand AASHTO H-20 loads.
    1. Base, Channel, and Bench: Concrete.
    2. Joint: Preformed flexible plastic gaskets complying with Fed. Spec. SS-S-210A.
    3. Size: As required to accommodate proposed pipes indicated on the drawings, 4-ft diameter minimum.
  - B. Frames and Covers: ASTM A48, Class 35B, heavy-duty cast iron. Include flat, round grate with 1-1/2" wide slotted drainage openings with a minimum total open area of 150-sq.in.
- 2.7 TRENCH DRAINS
- A. Description, General: Modular system of precast, polymer-concrete channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include number of units required to form total lengths indicated.
  - B. Heavy-Duty Trench Drain: Trench drain system in fire lane area shall be large capacity and heavy-duty sloped-invert, polymer-concrete system.
    1. Channel Sections: Interlocking-joint, precast, modular units with end caps. Include 12-inch minimum inside width and deep, rounded bottom, with built-in invert slope of 0.5 percent minimum and with outlets in number, sizes, and locations indicated. Include extension sections necessary for required depth. ACO PwerDrain S300K or approved equal.
    2. Ductile Iron Grates with manufacturer's designation "heavy-duty," 3,400-psi min. loading, with slots that fit recesses in channels. ACO S300K Slotted Iron or approved equal.
    3. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.
- 2.8 CLEANOUTS
- A. Description: ASME A112.36.2M, round, cast-iron housing with clamping device and round, secured, scoriated, cast-iron cover. Include cast-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug. Cleanout shall be rated for "heavy duty" top-loading classifications.
    1. Cleanout Box: Cleanouts located in paved areas subject to vehicular traffic shall be protected by an 8-in diameter, ductile-iron cleanout box. 'STORM' marking shall be cast into the lid.
- 2.9 CONCRETE
- A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:

1. Cement: ASTM C 150, Type I, 3,000-psi.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Structures: Portland-cement design mix, 4000 psi minimum, with 0.45 maximum water-cement ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615, Grade 60, deformed steel.

## PART 3 - EXECUTION

### 3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

### 3.2 SPECIAL PIPE COUPLING AND FITTING APPLICATIONS

A. Special Pipe Couplings: Use where indicated and where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.

### 3.3 INSTALLATION, GENERAL

A. General Locations and Arrangements: Drawings (plans and details) indicate the general location and arrangement of underground drainage systems piping. Location and arrangement of piping layout take into account many design considerations. Install piping as indicated, to extent practical. Refer to drawings for material and structure types for specific applications.

1. Orient grates of drainage structures in paved areas to align with general pattern of pavement joints and scoring.

B. 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 according to 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.

C. Use proper size increasers, reducers, and couplings, where different sizes or materials of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.

D. Extend drainage piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.

E. Install drainage piping pitched down in direction of flow, at minimum slope of 1 percent and 36-inch minimum cover, except where otherwise indicated.

F. Polyvinyl Chloride (PVC) Plastic Pipe and Fittings: As follows:

1. Join solvent-cement-joint pipe and fittings with solvent cement according to ASTM D 2855 and ASTM F 402.
2. Join pipe and gasketed fittings with elastomeric seals according to ASTM D 2321.
3. Join profile sewer pipe and ribbed drain pipe and gasketed fittings with elastomeric seals according to ASTM D 2321 and manufacturer's written instruction.
4. Install according to ASTM D 2321.

G. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and fit both systems' materials and dimensions.

### 3.4 CATCH BASIN AND DROP INLET INSTALLATION

A. Construct inlets to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

- C. Install prefabricated area drains per manufacturer's instructions.

### 3.5 TRENCH DRAIN INSTALLATION

- A. Install trench drains in accordance with the manufacturer's written instructions and as indicated on the drawings. Install surrounding concrete with surfaces with 1/4" per foot slopes to rim of grate.
- B. Extend drain pipe from in-line catch basin to large capacity site storm drainage system and install hardware mesh rodent screen over outlet of drain pipe and 12"x24" concrete splash block at discharge of drain pipe.
- C. Protect trench drain with non-woven filter fabric under grate during construction. Ensure trench and entire length of outlet pipe are clear of sediment and debris at completion of construction.

### 3.6 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping that is indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either of the following procedures:
  - 1. Close open ends of piping with at least 8-inch-thick brick masonry bulkheads.
  - 2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
- B. Abandoned Structures: Excavate around structure as required and use either of the following procedures:
  - 1. Remove structure and close open ends of remaining piping.
  - 2. Backfill to grade according to Division 31 Section "Earth Moving."

### 3.7 FIELD QUALITY CONTROL

- A. Clear interior of piping and structures of dirt and superfluous material as the 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 plug in end of incomplete piping at end of day and whenever work stops.
  - 3. Flush piping between manholes and other structures, if required by authorities having jurisdiction, to remove collected debris.
- B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of the Project.
  - 1. Submit separate reports for each system inspection.
  - 2. Defects requiring correction include the following:
    - a. Alignment: Less than full diameter of inside of pipe is visual between structures.
    - b. Deflection: Flexible piping with deflection that prevents passage of a ball or cylinder of a size not less than 92.5 percent of piping diameter.
    - c. Crushed, broken, cracked, or otherwise damaged piping.
    - d. Infiltration: Water leakage into piping.
    - e. Exfiltration: Water leakage from or around piping.
  - 3. Replace defective piping using new materials and repeat inspections until defects are within allowances specified.
  - 4. Reinspect and repeat procedure until results are satisfactory.
- C. Test new piping systems and parts of existing systems that have been altered, extended, or repaired for leaks and defects.
  - 1. Do not enclose, cover, or put into service before inspection and approval.
  - 2. Test completed piping systems according to authorities having jurisdiction.

3. Schedule tests, and their inspections by authorities having jurisdiction, with at least 24 hours' advance notice.
4. Submit separate reports for each test.

END OF SECTION 33 40 00